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IN THE

Supreme Court of the United States

OCTOBER TERM, 1985

EDWIN W. EDWARDS, in his Official Capacity as Governor of Louisiana, WILLIAM J. GUSTE, JR., in his Official Capacity as Attorney General of Louisiana, LOUISIANA DEPARTMENT OF EDUCATION, and THOMAS G. CLAUSEN, in his Official Capacity as Superintendent of Education of Louisiana,

Appellants,

v.

DON AGUILLARD *et al.*,

Appellees.

ON APPEAL FROM THE UNITED STATES COURT OF APPEALS FOR THE FIFTH CIRCUIT

JOINT APPENDIX
VOLUME 3

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G. BRIEF OF THE STATE IN OPPOSITION TO SUMMARY JUDGMENT (EXCERPTS ON FACTUAL ISSUES) (R.543, R.D.77)

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF LOUISIANA

DON AGUILLARD, et al., Plaintiffs,	)	
v.	)	CIVIL ACTION NO. 81-4787
EDWIN W. EDWARDS, et al., Defendants.	)	SECTION H

MEMORANDUM OF DEFENDANTS
IN OPPOSITION TO ACLU
MOTION FOR SUMMARY JUDGMENT
(Pursuant to Fed. R. Civ. P. 56(c)
and E.D. La. R. 3.10)

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III. ARGUMENT

INTRODUCTION

Summary judgment is absolutely inappropriate on the numerous material factual issues and on most legal issues in this case. Fed. R. Civ. P. 56(c). There are numerous genuine issues of material facts, such as whether creation-science is as scientific, as nonreligious, and as educationally worthwhile as evolution. Indeed, the State listed nearly 500 material factual issues, and the ACLU contested most of them and listed 188 additional factual issues that the State contests, in the related Keith v. Louisiana Department of Education case.1/ The legal

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1. These numerous factual issues are discussed in Part A of this Memorandum. The Keith lists of disputed factual issues appear in the "Appendix of Affidavits and Exhibits" as Appendices VI and VII.

issues in this case are mostly so intertwined with factual issues that they cannot properly be resolved in the absence of expert testimony and an otherwise full record.2/

This case differs vastly from McLean v. Arkansas Board of Education, 529 F.Supp. 1255 (E.D.Ark. 1982), for several critical reasons. The Balanced Treatment Act is (1) a significantly different statute in terms of wording (2) with an entirely different definition of creation-science and (3) with a markedly different legislative purpose. The (4) science and philosophy evidence and arguments differ markedly in the present case, as do (5) the expert witnesses and their planned testimony and (6) the academic freedom and establishment clause arguments. Further, we respectfully argue that the

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2. These legal issues are discussed in Part B of this Memorandum.

McLean decision was wrong, as expert testimony will demonstrate.3/

Overview of Material Factual Issues. The numerous material factual issues that preclude summary judgment (discussed in Part A immediately below4/) include issues of science, philosophy, history, theology, and education. The science issues include the definitions of creation-science and evolution,5/ the comparably scientific nature of

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3. The McLean decision is disputed throughout this Memorandum, and its definition of science is discussed in Section 3 [d](3) and thereafter, while its establishment clause analysis is analyzed in Part B below. This case also differs sharply from Epperson v. Arkansas, 393 U.S. 97 (1968), which is discussed in Part B, Section 2 [d](4) infra. The law in Epperson, unlike this case, (1) had the legislative purpose of unneutrally teaching the Genesis account of creation while excluding evolution, (2) forbade evolution instruction rather than giving it balanced treatment, and (3) involved the Genesis account of creation rather than creation-science.

4. Pp. F-38 et seq. infra.

5. Section I infra; Affidavits of Dr. Dean H. Kenyon, Dr. W. Scot Morrow, and

the creation-science and evolution explanations of the origin of the various organisms, the comparably scientific nature of their explanations of the origin of the first life, and the comparably scientific nature of their explanations of the origin of the universe.6/ The philosophy issues involve the definitions of science, the equal conformity of these scientific explanations to the erroneous McLean definition of science, and the status of creation-science and evolution as sole scientific alternatives.7/ The theological and historical issues include the definition of religion, the nonreligious nature of a creator

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Dr. Terry L. Miethe (attached as Exhibits I, II, and III).

6. Section 2[a]-[c] infra; Affidavits of Dr. Dean H. Kenyon and Dr. W. Scot Morrow (attached as Exhibits I and II).

7. Section 2[d]-[f] infra; Affidavit of Dr. Terry L. Miethe (attached as Exhibit III).

and creation in parallel relation to creation-science and evolution, the nonreligious nature of the parallel relations of these scientific explanations to religion, the nonreligious nature of the parallel history of religious involvement in the creation-evolution controversy, and the nonreligious nature of the parallel political pressure and lobbying on both sides of the controversy.8/ The educational issues concern the educational merit of public school teaching of alternative explanations, the educational merit of balanced treatment as a presentation of alternative explanations, and the educational bias of the current curriculum in Louisiana public schools.9/ (Affidavits are submitted in each of these fields.) The

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8. Section 3 infra; Affidavits of Dr. Terry L. Miethe and Rev. Dr. William G. Most (attached as Exhibits III and IV).

9. Section 4 infra; Affidavits of Dr. Robert Clinkert and Dr. Dean H. Kenyon (attached as Exhibits V and I).

other factual issues cover the lack of any impermissible primary effect, of any impermissible legislative purpose, and of any excessive entanglement from balanced treatment.10/ The falsity of the ACLU charge, that balanced treatment is the result of a narrow Fundamentalist thrust, can be seen in the broad support by eighty-six percent of the general public for public school instruction in creation-science, according to many scientific surveys.11/ All of these which will be supported by expert testimony are material factual issues.

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10. Section 5 infra.

11. E.g., Stacey* & Shupe*, Religious Values and Religiosity in the Textbook Adoption Controversy in Texas 1981, 25 Rev. of Religious Research 321, 326 (1984); Parallel Teaching of Creation Theories, San Diego Union, Nov. 18, 1981, at A-15 (Associated Press-NBC News scientific survey). The percentage of religious moderates supporting creation-science instruction is 73.4%, of Protestants is generally __%, and of Roman Catholics is 72.4%, according to one scientific poll. Stacey* & Shupe*, supra at 316.

Expert testimony by the State's witnesses, who include both creationists and evolutionists and who span the theological spectrum from Protestant to Catholic to Jewish to non-Judeo-Christian to Agnostic, will demonstrate that creation-science is scientific and nonreligious, and in fact that creation-science is as scientific and as nonreligious as evolution. Expert testimony by the State's education professors will show that balanced treatment has great educational merit and is educationally feasible. Expert testimony by the State's history-theology witnesses will show that any historical and theological consistency of creation-science with religion is no greater than the parallel consistency of evolution with religion.

The initial reaction of some people to this case is that evolution is as certain as any scientific theory can be, and conse-

quently is not subject to challenge by any scientific alternative. However, "scientists who utterly reject evolution may be one of our fastest-growing controversial minorities."12/ There are "some among the biologists who feel that much of the fabric of [evolutionary] theory accepted by the majority today is actually false," and "a generally silent group of students engaged in biological pursuits who tend to disagree with much of the current thought."13/ Grassé*, "the most distinguished of French zoologists,"14/ published a book concluding that "the explanatory doctrines of biological evolution do not stand up to an ob-

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12. Hatfield*, Educators Against Darwin, Science Digest Special, Winter 1979, at 94, ____.

13. Olson*, Morphology, Paleontology, and Evolution, in 1 Evolution after Darwin 523, 523 (S. Tax ed. 1960).

14. Dobzhansky*, Book Review, 29 Evolution 376, 376 (1975).

jective, in-depth criticism."15/ Large-scale evolution has similarly been rejected or severely criticized by such other noncreationist scientists as Kerut*, Patterson*, Vernet*, and Sermonti* and Fondi*,16/ as well as such recent noncreationists as Hitching*, Taylor*, Macbeth*, and Rifkin*.17/ Koestler* concludes that the evolutionary "citadel they are defending lies in ruins"; Rifkin* calls it "little more than an imaginary trip"; and Bethell sees "Darwin's theory . . . on the verge of

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15. P. Grassé*, Evolution of Living Organisms 202 (trans. 1977).

16. E.g., G. Kerkut*, Implications of Evolution 15 passim (1961); Address of Dr. Colin Patterson*, American Museum of Natural History, tr. at 4 (Nov. 5, 1981) ("The second theme is that evolution not only conveys no knowledge but seems somehow to convey antiknowledge . . . ."); M. Vernet*, Révolution en Biologie (1969); G. Sermonti* & R. Fondi*, Dopo Darwin: Critica all' Evoluzionismo (1980).

17. E.g., F. Hitching*, The Neck of the Giraffe: Where Darwin Went Wrong (1982); G. Taylor*, The Great Evolution Mystery 137-

collapse."18/ Among high school teachers, "a significant minority of them simply do not believe a word of it."19/ Yet, "biology is not being accurately represented to the public," and is being taught in public schools "as dogmatic truth" with "no alternative theory of the evidence" offered and "no critical examination of assumptions and incongruities ever encouraged."20/

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38 (1983)("the theory of evolution by natural selection seems either inadequate, implausible or definitely wrong."); N. Macbeth*, Darwin Retried (1971); J. Rifkin*, Algeny 135 (1983) ("Darwin and his twentieth-century apologists have been in error.").

18. A. Koestler*, Janus: A Summing Up 192 (1978); J. Rifkin*, Algeny ___ (1983); T. Bethell*, Darwin's Mistake, Harper's Magazine, Feb. 1976, at 70, 72.

19. G. Simpson*, This View of Life 30 (1964).

20. G. Williams*, Adaptation and Natural Selection 55 (1966); T. Roszak*, Unfinished Animal 99-100 (1975). Roszak* describes the situation as follows:

> When I learned my basic Darwin in high school--and neoDarwinism and new genetics in college--I learned it as dogmatic truth, as I might have learned a religious catechism. Not in the sense

There are hundreds or thousands of creationist scientists, who have concluded that creation-science is scientific and nonreligious, and that the scientific evidence supports creation-science better than evolution.21/ A New Republic article acknowledges that "[t]he leading participants on the creationist side--who are often portrayed as Bible-thumpers, but have science Ph.D.s--are in fact scientists."21a/ There are also many noncreationists, including

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> that no physical evidence was adduced --there was enough of that--but in the sense that no alternative theory of the evidence was ever introduced, no critical examination of assumptions and incongruities ever encouraged. Indeed, I was led to believe that the only alternative to orthodox biology was biblical fundamentalism and the "creationist" movement. . . .

Id.

21. E.g., Affidavit of Dr. Dean H. Kenyon (attached as Appendix I).

21a. Bethell, A Challenge to Materialism, New Republic, Aug. 1, 1983, at 34, 36.

Agnostics and Atheists, who support balanced treatment of creation-science and evolution,22/ along with more than three-fourths of the general public. The scientific basis for these conclusions is discussed later.

Overview of Legal Issues. The legal issues in this case (discussed in Part B below 23/) are inextricably intertwined with the above factual issues, and so cannot be resolved without a full record including exhibits and expert testimony in biology, chemistry, astrophysics, philosophy, education, theology, and history. These legal issues involve academic freedom,

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22. E.g., Provine*, Theories of Creation and Evolution from a Historical Perspective (unpublished) lecture before Sigma XI Chapter, Corning, N.Y., Nov. 17, 1981) ("First, I agree with him that creationism should be taught along with evolutionism from grade school through high school."); Affidavit of Dr. W. Scot Morrow* (attached as Appendix II.)

23. [Omitted from J.A.]

the establishment clause, and due process. The academic freedom issue is that academic freedom is enhanced by balanced treatment of creation-science and evolution, for both students and teachers.24/ The establishment clause issues are that balanced treatment for creation-science is constitutional under U.S. Supreme Court precedent regarding reference to a creator and under alternative tests to the tripart test, that the primary effect of balanced treatment under the establishment clause is the constitutional effect of advancing academic freedom and providing more scientific information, that the legislative purpose of balanced treatment is the constitutional purpose of advancing academic freedom, that no excessive entanglement between church and state results from balanced treatment, and that this case

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24. Part B, Section 1 infra.

differs critically from the McLean case.25/ The due process issue is that the balanced treatment requirement is sufficiently clear in meaning.

The basic legal issues in this case are academic freedom for students and teachers, and neutral public school instruction in additional scientific information, which is forbidden only by the unprecedented absolute approach to the establishment clause advocated by the ACLU and consistently rejected by the U.S. Supreme Court. Expert testimony at trial will show that the primary effect and legislative purpose for the challenged Act are to advance academic freedom in a neutral manner, by providing more scientific information; and that no excessive entanglement will result.

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25. Part B, Section 2 infra.

Caveats. The State is not seeking to argue in this case that creation-science is ultimately correct or that evolution is ultimately false, but simply that balanced treatment of both scientific explanations is constitutional, because creation-science is legitimately scientific and nonreligious whereas evolution is not conclusive fact. The State agrees wholeheartedly that public schools constitutionally may not and should not teach the Genesis account of creation or religious views of evolution in science classes, and will demonstrate that creation-science differs as much from Genesis (and the rest of the Torah and the Koran) as evolution differs from evolutionist religions. For both creation and evolution, science may be taught and religion may not be in public school science classes.

Note: The authorities cited and quoted in this Memorandum are virtually all noncreationists, and are evolutionists in most known cases. (The few creationist scientists and philosophers quoted are specifically identified as creationists.) The purpose is to prepresent background scientific and other other data from the general literature in various fields.

* * * *

Conclusion. Summary judgment would be totally erroneous in this case, first because of the numerous genuine issues of material fact (which the plaintiffs have admitted to be such in the related Keith case); second because of the expert opinion, constitutional issues, legislative purpose and intent, important public issues, and complexity of this case, under Supreme Court and Fifth Circuit precedent; and third because the questions of effect-purpose-entanglement are themselves factual issues.

A. MATERIAL FACTUAL ISSUES

SUMMARY

This case involves not just one but scores of genuine issues of material fact. The ACLU has admitted this by judicially denying most of the 500 factual issues listed by the State in Keith v. Louisiana Department of Education,27/ and then by listing 188 additional factual issues that the State mostly contests.28/ In fact, the ACLU is thereby estopped from denying the existence of a large number of genuine factual issues, because that was a related case on identical issues between substantially

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27. Pretrial Brief of Plaintiffs at 1-60, Keith v. Louisiana Department of Education, No. 81-989B (M.D. La. filed Dec. 2, 1981) (attached as Appendix VI).

28. Pretrial Brief of Defendants 1-26, 27-61, id. (attached as Appendix VII).

similar parties.29/ The material factual issues discussed below include the following:

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29. This is based on judicial estoppel and on judicial admission. "Judicial estoppel," or "preclusion by inconsistent positions," is described by Moore as follows:

> Preclusion by inconsistent positions, or judicial estoppel, is limited to change of position taken in judicial proceedings . . .. Many cases, however, have recognized that independent of res judicata, collateral estoppel, or equitable estoppel traditionally conceived, a litigant is not completely free to argue whatever state of facts seems advantageous at a point in time, and a contradictory state whenever self-interest may dictate a change. As it has been put in a number of cases, one may not play "fast and loose" with the judicial process.

11 Moore's Federal Practice ¶0.405[8], at 239-40 (2d ed. J. Moore, J. Lucas & T. Currier eds. 1983) (footnotes omitted). See also In re Double D Dredging Co., 467F.2d 468, 469 (5th Cir. 1972).

Judicial admission is also shown to be applicable in the following Fifth Circuit decision:

> As a general rule the pleading of a party made in another action, as well as pleadings in the same action which have been superseded by amendment, withdrawn or dismissed, are admissible to admissions of the pleading party to the facts alleged therein, assuming of course that the usual tests of rele-

1. MATERIAL FACTUAL ISSUES ABOUT THE DEFINITIONS OF CREATION-SCIENCE AND EVOLUTION
2. MATERIAL FACTUAL ISSUE THAT CREATION-SCIENCE IS AS SCIENTIFIC AS EVOLUTION
    a. Creation-Science Is as Scientific as Evolution concerning the Origin of the Various Living Organisms
    b. Creation-Science Is as Scientific as Evolution concerning the Origin of the First Life
    c. Creation-Science Is as Scientific as Evolution concerning the Origin of the Universe

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vancy are met. Raulie v. United States, 10 Cir., 1963, 400 F.2d 487; Ross v. Philip Morris & Company, 8 Cir. 1964, 328 F.2d 3; Great American Indemnity Company v. Rose, 5 Cir., 1957, 242 F.2d 269; Borel v. United States Casualty Company, 5 Cir., 1956, 233 F.2d 385; Fuller v. King, 6 Cir., 1954, 204 F.2d 586. See Rule 8-04(b)(4) Proposed Federal Rules of Evidence (1969). Continental Insurance Co. v. Sherman, 439 F.2d 1294, 1298 (5th Cir. 1971).

d. Accepted Definition of Science Conflicts with the McLean Definition

e. Creation-Science and Evolution Equally Meet the McLean Definition of Science

f. Sole Alternatives Are Creation-Science and Evolution

3. MATERIAL FACTUAL ISSUE THAT CREATION-SCIENCE IS AS NON-RELIGIOUS AS EVOLUTION

a. Accepted Definition of Religion Conflicts with the McLean Approach

b. Creation-Science and Evolution Are Equally Non-Religious in the Concepts of Creation and a Creator

c. Creation-Science and Evolution Are Equally Non-Religious in Their Parallel Consistency with Religion

d. Creation-Science and Evolution Are Equally Non-Religious in Their Parallel History of Religious Involvement in the Creation-Evolution Controversy

e. Creation-Science and Evolution Are Equally Non-Religious in Their Parallel Political Activity

4. MATERIAL FACTUAL ISSUE THAT BALANCED TREATMENT OF CREATION SCIENCE IS AT LEAST AS EDUCATIONALLY MERITORIOUS AS EXCLUSIVE INSTRUCTION IN EVOLUTION

a. Public School Presentation of Alternative Explanations Has at Least the Educational Merit of Other Approaches

b. Balanced Treatment of Creation-Science with Evolution Has at Least the Educational Merit of Exclusive Instruction in Evolution

c. Current Instruction in Louisiana Public Schools Exclusively Teaches Evolution and Excludes Creation-Science

d. Widespread Discrimination Exists against Creationists by Schools and Science Publications

5. MATERIAL FACTUAL ISSUES THAT NO IMPERMISSIBLE PRIMARY EFFECT, IMPERMISSIBLE LEGISLATIVE PURPOSE, OR EXCESSIVE ENTANGLEMENT RESULT FROM BALANCED TREATMENT OF CREATION-SCIENCE AND EVOLUTION

   a. Balanced Treatment Act Has the Permissible Primary Effect of Providing More Scientific Information

   b. Balanced Treatment Act Has the Secular Legislative Purpose of Advancing Academic Freedom

   c. Balanced Treatment Will Not Produce Excessive Entanglement

The following Section defines creation-science and evolution. Section 2 then addresses the science and philosophy factual issues, arguing that creation-science is as scientific as evolution. Section 3 discusses the theology and history factual issues, contending that creation-science is as non-religious as evolution. Section 4 then

considers the education factual issues, suggesting that balanced treatment with creation-science is at least as educationally meritorious as exclusive instruction in evolution. Finally, Section 5 assesses the factual issues of the primary effect, legislative purpose, and nonentanglement of balanced treatment.

The ACLU has chosen "the legal strategy . . . to focus on creation-science, not on evolution," and has rejected "point-by-point refutation of creation-science . . . as a strategy," just as it said in print it had done in the McLean case.30/ However, the State must discuss evolution as well as creation-science in order to show the comparative scientific nature and nonreligious nature of creation-science, and in order to

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30. M. LaFollette*, Introduction, in Creationism, Science and the Law, 1, 7 (M. LaFollette* ed. 1983).

show that evolution is not so conclusively established as to preclude any alternative explanation. The ACLU's tactical choice must not restrict the State's right to present its case.

For the State to prevail on summary judgment, its burden is only to show the existence of any material factual issues (and there are hundreds). For the State to prevail at trial, the State actually does not necessarily have to demonstrate that creation-science is equally scientific as evolution or even that creation-science is scientific at all (although it indeed is), or that balanced treatment is as educationally meritorious as evolution instruction (although it actually is), but simply that creation-science is not religious under the establishment clause's definition of religion. However, these other factual issues are important in defining what creation-

science actually is, in showing that it is far from religion in the establishment clause sense, and in identifying the constitutional primary effect and secular purpose for balanced treatment.

1. MATERIAL FACTUAL ISSUES ABOUT THE DEFINITIONS OF CREATION-SCIENCE AND EVOLUTION

> Education, you know, means broadening, advancing, and if you limit a teacher to only one side of anything the whole country will eventually have only one thought, be one individual. I believe in teaching every aspect of every problem or theory.
>
> --John T. Scopes* at the Scopes trial32/

One group of material factual issues under dispute is the definitions of creation-science and evolution-science, and their distinctions from evolutionist religions and creationist religions.

a. Definition of Evolution

"Evolution-science" is defined by the Balanced Treatment Act as "the scientific evidences for evolution and inferences

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32. P. Davis & E. Solomon*, The World of Biology 414 (1974).

from those scientific evidences."33/ This equates "evolution-science" with "scientific evidences for evolution," and the terms are indeed equivalent.33a/

"Evolution" has three major scientific aspects, which are described by leading evolutionists Dobzhansky*, Ayala*, Stebbins*, and Valentine*:

> During the century and more since Darwinism came into being, the concept of evolution has been applied not only to the living world but to the nonbiological as well. Thus, we speak of the evolution of the entire universe, the solar system and the physical earth, apart from the organisms that inhabit it. As we shall show in Chapter 11 ("Cosmic Evolution and the Origin of Life"), the origin of life is best explained as the outcome of precellular chemical evolution, which took place over millions of years. We also speak of social or cultural evolution.34/

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33. La. Stat. §_____.

33a. Affidavit of Dr. Dean H. Kenyon at 3 (attached as Exhibit I); Affidavit of Dr. W. Scot Morrow at 2 (attached as Exhibit II).

34. T. Dobzhansky*, F. Ayala*, G. Stebbins* and J. Valentine*, Evolution 9 (1977).

Thus, evolution includes biological evolution, biochemical evolution, and cosmic evolution:

a.	Biological evolution (or organic evolution):	Evolution of organisms all from one or more common ancestors, so that single celled organisms evolved into invertebrate fish and plants, then vertebrate fish, then amphibians, then reptiles, then lower mammals, then primates, then man ("macroevolution"); 35/
b.	Biochemical evolution (or chemical evolution):	Evolution of the first life from non-life; and 36/
c.	Cosmic evolution (or stellar	Evolution of the universe, including galaxy clus-

35. The general scientific use of the term "biological evolution" is supported in n. 194 infra.

36. The general scientific use of the term "biochemical evolution" is supported in nn. 507-09 infra.

evolution):	ters, galaxies, stars, and solar systems.37/

Similar terms and definitions are given in a multitude of other standard works on evolution.38/

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37. The general scientific use of the term "cosmic evolution" is supported in nn. 656-57 infra.

38. A similar definition is given by leading evolutionist Mayr* :

> Man's world view today is dominated by the knowledge that the universe, the stars, the earth and all living things have evolved through a long history that was not foreordained or programmed, a history of continual, gradual change shaped by more or less directional natural processes consistent with the laws of physics. Cosmic evolution and biological evolution have that much in common.
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> . . ..
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> [See "Chemical Evolution and the Origin of Life" by Richard E. Dickerson, p. 70].

Mayr*, Evolution, Scientific American, Sept. 1978, at 47, 47, 51. Another such definition is given by Blum*:

> Most works dealing with organic

The ACLU has argued that "evolution" is restricted to biological evolution. That argument is contradicted by the community of scientists. A late leading evolutionist, Dobzhansky*, stated "that the concept of evolution is much broader":

> evolution focus attention on its strictly biological aspects, disregarding to a great extent those physical factors that have determined the basic pattern along which living systems could subsequently develop. To understand these factors and restrictions, one needs to go back to the origin of life, and beyond into the domains of terrestrial and cosmic evolution.

H. Blum*, Time's Arrow and Evolution 4 (3d ed. 1968). Accord, Huxley*, At Random, in 3 Evolution after Darwin 41-65 (S. Tax ed. 1960), ("it is evolution, in the broad sense, that links inorganic nature with life, and the stars with earth, and matter with mind, and animals with man."); E. Olson* & J. Robinson*, Concepts of Evolution 10 (1975) ("Evolutionism is the doctrine that the universe, including inorganic and organic matter in all its manifestations is the product of gradual and progressive development."); Wilson*, The Origin of Life, in Did the Devil Make Darwin Do It? (D. Wilson*, ed. 1983) ("Evolution, which

Although this article is concerned with biological evolution, it should be recognized that the concept of evolution is much broader. There is also cosmic, or inorganic, evolution, and evolution of human culture. One of the theories advanced by cosmologists sets the beginning of cosmic evolution between 5 and 10 billion years ago. The origin of life, which started biological evolution. took place 3 or 4 billion years ago.39/

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is the strongest natural explanation, holds that the gross features of the universe--including galaxies, solar systems and planets; the transition from non-living matter to living organisms; and the diversity of life forms, including human beings--all arose as a consequence of the innate proclivities of matter and energy, as expressed by the laws of nature."); J. Jarrett*, Philosophy for the Study of Education 346 (1969) (on Herbert Spencer*).

39. T. Dobzhansky*, Evolution, in 10 Encyclopedia Americana 734, 734 (1982). Sir Julian Huxley* wrote similarly:

> I am quite aware that many people object to the use of the term evolution for anything but the transformations of living substance. But I think this is undesirably narrow. Some term is undoubtedly needed for the comprehensive process in all its aspects, and no other convenient designation exists at present save that of evolution.
>
> The over-all process of evo-

The basic meaning of "evolution" is not merely change; creationist scientists agree that change occurs in organisms and the universe. Instead,

> Clearly, a definition of organic evolution is needed that includes all of its aspects and at the same time

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> lution in this comprehensive sense comprises three main phases. . . . We may call these three phases the inorganic or, if you like, cosmological; the organic or biological; and the human or psychosocial.

J. Huxley*, Evolution in Action 10 (1964).

40. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 8 (1977). Accord, Gruner*, On Evolution and Its Relation to Natural Selection 16 Dialogue 708, 709 (1977) ("This becomes clear when we reflect on what is meant by 'evolution'. When applied to organic nature the term does not refer merely to change or even gradual change."); W. Stansfield*, The Science of Evolution 9 (1977) ("For example, the assertation that populations of organisms can change in their genetic composition from one generation to another (i.e., evolve) is undisputed, even by the creationists."); N. Eldredge* & I. Tattersall*, The Myths of Human Evolution 3 (1982)("If ever there was a myth, it is that evolution is a process of constant change.").

> distinguishes between evolution and mere change. . . . Transformation is a better concept than "change" 40/

Biological evolution instead is the view, according to ACLU witnesses Ayala* and Gould*, that

> The millions of diverse living species we find around us in the modern world are all descended from a common ancestor that lived in the remote past (Fig. I.1). The processes that have brought this diversity about are collectively called evolution.41/

> Evolution. The process by which all organisms have arisen by descent from a common ancestor.42/

The standard scientific literature defines biological evolution to include descent of all plants and animals from a common ancestor.43/ This descent involves change "from

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41. F. Ayala* & J. Valentine*, Evolving: The Theory and Process of Organic Evolution 1 (1979) (college textbook).

42. S. Luria*, S. Gould* & S. Singer*, A View of Life 767 (1981) (college textbook).

43. R. Oram*, Biology: Living Systems 118, 248-67, 277-94, 602-23, 73T-80T, 142T-45T (3d Ed. Teacher's ed. 1979) (high school

primordial life, through unicellular and multicellular organisms, invertebrate and vertebrate animals, to man. . . ."44/

The term "evolution-science" is a scientific term. Stansfield* entitled his book The Science of Evolution, and Huxley* wrote that "evolutionary science is a discipline or subject in its own right."45/ Many high school and elementary school textbooks and

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text) ("evolved from a single, original, common ancestor."); J. Smith*, The Theory of Evolution 152 (1958) ("The theory of evolution holds that existing plants and animals have originated by descent with modification from one or a few simple ancestral forms."); C. Patterson*, Evolution ___ (1978) ("The first is the general thesis that evolution has occurred--all animal and plant species are related by common ancestry . . ."); Thompson*, Marginalia: The Meanings of Evolution, 70 Am. Scientist 529, 529 (1982); W. Stansfield*, The Science of Evolution 3 (1977) ("Evolution is a scientific theory proposing that higher forms of life have descended from lower forms").

44. T. Dobzhansky*, Evolution, 10 Encyclopedia Americana 734, 748 (1982).

45. W. Stansfield*, The Science of Evolution (1977); J. Huxley*, Evolution in Action 9 (1964) ("Evolutionary science").

courses are similarly entitled Biological Science, Life Science, Physical Science, Environmental Science, and similar names.46/ Besides these disciplines, many academic fields are also termed "_____ science," such as natural sciences, nuclear science, information science, and computer science.

This definition of evolution is a material factual issue.

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46. The following texts are on the state adopted list for Louisiana. E.g., Biological Sciences Curriculum Study*, Biological Science: Molecules to Man (3d ed. 1973 & 1976); Biological Sciences Curriculum Study, Biological Science: An Inquiry Into Life Interaction of Experiments and Ideas (3d ed. 1977); Physical Science Investigations (1976); Physical Science Investigations (rev. ed. 1979); Introductory Physical Science (4th ed. 1982); Physical Science Text-Workbook (1982); Challenges: Physical Science (1973); Introduction to Environmental Science (1980); Environmental Science: The Way the World Works (1981); Earth Science (1973).

b. Definition of Creation-Science

"Creation-science" is defined by the Balanced Treatment Act as "the scientific evidences for creation and inferences from those scientific-evidences."47/

The term "creation" means origin through abrupt appearance in complex form. It was so defined over a century ago by Professor Louis Agassiz of Harvard, "America's leading biologist"48/ of his time and the leading creationist scientist of that time:

> All attempts to explain the origin of species may be brought under two categories: viz. 1st, some naturalists admitting that all organized beings are created, that is to say, endowed from the beginning of their existence with all their characteristics, while 2d,

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47. La. Stat. §_____.

48. Gould*, Catastrophes and Steady State Earth, Natural History, Feb. 1975, at 15, 15-16.

> others assume that they arise spontaneously.49/

Creation was similarly defined over two decades ago by Dr. Evan Shute, also a creationist:

> The lower four-fifths of the rock of the earth's crust is lifeless. Then life suddenly appears, is at once general across the earth, and promptly demonstrates most of the types we now know. This is not the evidence the evolutionist wants, and is quite fatal to his claims. This is Creation.50/

Similarly, creation was used over a century ago by Professor J. D. Hooker* in the sense of "appearing or originating,"51/ and three

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49. 3 L. Agassiz, Contributions to the Natural History of the United States 1861 excerpted in 30 Am J. of Science 142, 149 (1860).

50. E. Shute, Flaws in the Theory of Evolution 5 (1961).

51. N. Gillespie*, Charles Darwin and the Problem of Creation 29 (1979); Elders, The Philosophical and Religious Background of Charles Darwin's Theory of Evolution, Doctor Communis 1, 7 (1984) (address to Royal Spanish Academy of the Sciences).

decades ago by Gold* Bondi*, and Hoyle in the continuous creation hypothesis to describe the abrupt appearance of hydrogen atoms.52/ The term is currently used by many advocates of the big bang hypothesis to describe the abrupt appearance of the universe,53/ and by Sir Fred Hoyle and other advocates of the directed panspermia hypothesis to describe the abrupt appearance in complex form of microbes from space.54/ "Creation-science" has been defined differently by various people and groups, but the above definition is the most generally accepted one and will be supported by expert testimony in biology, biochemistry, and physics.

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52. Section 3[b][1)(c) infra.
53. Section 3[b](1)(b) infra.
54. F. Hoyle & N. Wickramasinghe, Evolution from Space: A Theory of Cosmic Creation (1984). See also 2 Oxford English Dictionary 1152 (1961).

"Creation-science" has three aspects parallel to those of evolution:

a.	Biological creation:	Creation of genera or families of organisms recognizing genetic variation ("microevolution") in all genera/families within genetic limits and extinction of some genera/families;
b.	Biochemical creation:	Creation of the first life; and
c.	Cosmic creation:	Creation of the universe, including galaxy clusters, galaxies, stars, and the solar system.

The following sections discuss affirmative scientific evidence and related scientific interpretations that constitute creation-science, giving 6 affirmative scientific evidences for biological creation, 5 for biochemical creation, and 5 for cosmic creation. Examples of this scientific evidence are the abrupt appearance

of complex organisms in the fossil record, the systematic gaps between genera/families of organisms in the fossil record up to the present, and the radiohalos in the earth's crust without uranium traces nearby.55/

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55. Sections 2[a]-[c] infra. For example, Dr. Dean V. Kenyon, a creationist scientist, concludes that creation-science is scientific and credible:

> It is my conviction that if any professional biologist will take adequate time to examine carefully the assumptions upon which the macroevolutionary doctrine rests, and the observational and laboratory evidence that bears on the problem of origins, he/she will conclude that there are substantial reasons for doubting the truth of this doctrine. Moreover, I believe that a scientifically sound creationist view of origins is not only possible, but is to be preferred over the evolutionary view.
>
> We have seen that evidence often taken to support a naturalistic chemical origin of life, actually, upon close analysis, points in another direction, namely, toward the conclusion that the first life was created. The data of molecular biology, especially the details of the genetic-coding and protein-synthesizing systems, lend further powerful support to this view.

These affirmative evidences are not a new concept, and in fact those for biological creation were essentially stated 125 years ago by Professor Louis Agassiz of Harvard, as described below.56/

There are several misconceptions about creation-science. It does not essentially involve creation "from nothing," because that concept is not necessary to

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> Probability arguments applied to the problem of the origin of genetic information also confirm the creationist view of origins.
>
> Laboratory data and theoretic arguments concerning the origin of the first life lead one to doubt the evolution of subsequent forms of life. The fossil record and other lines of evidence confirm this suspicion. In short, when all the available evidence is carefully assessed in toto, the evolutionary story of origins appears significantly less probable than the creationist view.

Kenyon, The Creationist View of Biological Origins, NEXA Journal, Spring 1984, at 28, 28, 33.

56. Section 2[a](1) infra.

abrupt appearance in complex form.57/ Creation-science does not involve "kinds" of plants or animals, because that concept is generally outside the realm of empirical

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57. However, the concept of origin "from nothing" or "ex nihilo" is not necessarily religious. Some noncreationist physicists and astronomers such as Guth* of MIT, Tryon* of Hunter, and Vilenkin* of Tufts, have scientifically reached the conclusion that the universe appeared "ex nihilo":

> Recently there has been some serious speculation that the actual creation of the universe is describable by physical laws. In this view the universe would originate as a quantum fluctuation, starting from absolutely nothing.
>
> . . . From a historical point of view probably the most revolutionary aspect of the inflationary model is the notion that all the matter and energy in the observable universe may have emerged from almost nothing.

Guth* & Steinhardt*, The Inflationary Universe, Scientific American, May 1984, at 116, 128. Accord, Tryon*, What Made the World?, New Scientist, Mar. 8, 1984, at 14, 16 ("In 1973, I proposed that our Universe had been created spontaneously from nothing (ex nihilo), as a result of established principles of physics."); H. Bondi*, Cosmology 1444 (19__); F. Hoyle, The Nature of the Universe 125 (1950).

data and scientific interpretations, but instead involves families or genera as "natural groups."58/ Creation-science also

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58. The concepts of genus and family are standard terms of biological classification. Note 69 infra. The word "types" has been used by many creationists since before 1860 (by Agassiz), and is a scientific term different in meaning from "kinds." Nn. 69-70 infra. However, the word "kinds" in reference to taxa is not necessarily religious, and appears frequently in the scientific literature. E.g., W. Stansfield*, The Science of Evolution 98, 511 (1977); A. Boyden*, Perspectives in Zoology 117 (1973); S. Stanley*, Macroevolution 193 (1979); N. Eldridge* & I. Tattersall*, The Myths of Human Evolution 8 (1982) ("another kind of early man"); Hull*, Karl Popper and Plato's Metaphor, in 2 Advances in Cladistics 177, 177, 188 (N. Platnik* & V. Funk* eds. 198); Eldredge*, An Extravagance of Species, Natural History, June 1980, at 47, 50; Valentine*, The Evolution of Multicellular Plants and Animals, Scientific Am., Sept. 1978, at 141, 158; Manser*, The Concept of Evolution, 40 Philosophy 18, 27 (1965); S. Luria*, S. Gould*, & S. Singer*, A View of Life 636 (1981); D. Raup* & S. Stanley*, Principles of Paleontology 104 (2d ed. 1978); A. Wallace*, The World of Life 12-13 (19) ("The reader may therefore rest assured that there is no mystery in the word species, but that he may take it as meaning the same as kind in regard to animals and plants in a state of nature.").

does not essentially involve "catastrophism" or a "worldwide flood", because those concepts are not related at all to the origin of the universe, the first life, and the various organisms. These are certainly not essential elements of creation-science.59/ Finally, creation-science does not essentially involve a "relatively recent inception" or "young age" of the universe and life, because the scientific evidence for biological creation, biochemical creation, and cosmic creation does not depend at all on any particular time frame. This is certainly not

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59. Those scientists who describe themselves as creationists split about evenly on acceptance or rejection of catastrophism and a worldwide flood. Those rejecting catastrophism and a worldwide flood include most of the American Scientific Affiliation, etc. Historically, great scientists advocating a worldwide flood include Sir Isaac Newton, Nicholas Steno, William Whiston, John Woodward, Georges Cuvier, Timothy Dwight (President of Yale), and William Buckland (Professor of Geology at Oxford).

an essential element of creation-science.60/ This definition is a material factual issue.

c. Distinction between Evolutionist Religions and Evolutionary Science

In contrast to evolutionary science, there are numerous evolutionist religions (religions holding to theological beliefs in evolution). Although most people are aware of some creationist religions, they are often not aware that parallel evolution-

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60. Those scientists who describe themselves as creationists similarly split about evenly on a young age or multibillion-year age of the universe, earth, and life. Those in the twentieth century advocating a multibillion year age include most of the members of the American Scientific Affiliation, State expert witness Walter L. Bradley, chemist Charles Thaxton, etc. Those scientists in the nineteeth century advocating an old age include Agassiz, Phillip H. Gosse, John William Dawson, and James Dana. E.g., 1 L. Agassiz, Contributions to the Natural History of the United States of America 53, 56 (1857). Historically, great scientists advocating a young age include Sir Isaac Newton, Johannes Kepler, and Lord Kelvin.

ist religions (whether explicit or implicit) fall in every theological category, embracing Protestant, Catholic, Jewish, and non-Judeo-Christian faiths:

Theological Category	Evolutionist Religions
(i) Protestant:	Theological Liberalism & NeoOrthodoxy; Religious Humanism & Unitarianism;
(ii) Catholic:	NeoModernist Roman Catholicism;
(iii) Jewish:	Reform Judaism; and
(iv) Non-Judeo-Christian:	Buddhism & Hinduism, Secular Humanism & other Humanist faiths, Nontheistic religions and Atheism.

These evolutionist religions are discussed with extensive documentation below.61/

d. Distinction between Creationist Religions and Creation-Science

In contrast to creation-science, there

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61. Section 3[c](1)(a) infra.

are creationist religions just as there are evolutionist religions. Although most people are aware of the existence of creationist religions, they are often not aware that these religions span the theological spectrum just as evolutionist religions do, including not just Protestant but Catholic, Jewish, and non-Judeo-Christian faiths:

Theological Category	Creationist Religions	Evolutionist Religions
(i) Protestant:	Conservative Evangelicalism & Fundamentalism; Church of Christ & Seventh Day Adventism;	Theological Liberalism & NeoOrthodoxy; Religious Humanism & Unitarianism
(ii) Catholic:	Orthodox Roman Catholicism & Eastern Orthodoxy;	NeoModernist Roman Catholicism
(iii) Jewish:	Orthodox Judaism; and	Reform Judaism; and

(iv) Non-Judeo-Christian:	Islam (Muslims) etc.	Buddhism & Hinduism, Secular Humanism & other Humanist faiths, Nontheistic religions & Atheism.

These creationist religions and their evolutionist religion counterparts are discussed in Section 3[c](1) below.62/ The point made here is that creation-science is as different from creationist religions as evolution-science is from evolutionist religions. This is a material factual issue.

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62. Section 3[c](1)(b) infra.

2. MATERIAL FACTUAL ISSUES THAT CREATION-SCIENCE IS AS SCIENTIFIC AS EVOLUTION

> I look with confidence to the future, --to young and rising naturalists, who will be able to view both sides of the question with impartiality.
> -- Charles Darwin*, in The Origin of Species 63/

Overview. This Section covers the most important group of material factual issues and discusses the scientific nature of creation-science and evolution, the accepted definitions of science, conformity to the erroneous McLean definition of science, and the status of creation-science and evolution as the sole scientific alternatives. Section [a] discusses the origin of the various living organisms and the scientific nature of biological creation and biological evolution. Section [b] describes the origin of the

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63. C. Darwin*, The Origin of Species 521 (1909).

first life and the scientific nature of biochemical creation and biochemical evolution. Section [c] discusses the origin of the universe and the scientific nature of cosmic creation and cosmic evolution. These Sections also discuss the differences of the instant case from the McLean case. Section [d] summarizes the commonly accepted definitions of science and the absolute erroneousness of the tactically contrived ACLU definition that was adopted in McLean. Section [e] discusses the parallel conformity of creation-science and evolution to the McLean definition of science, if it is followed in part. Finally, Section [f] discusses the status of creation-science and evolution as sole scientific alternatives. Each of these Sections discusses a material factual issue, and their Subsections discuss subsidiary material factual issues.

Of course, the most critical factual

issue is whether creation-science is religious in the establishment clause sense. The following Sections [a] through [f] argue that creation-science actually is as scientific as evolution, because creation-science consists of a score of affirmative empirical evidences and related scientific interpretations. Even if this Court disagrees that creation-science is as scientific as evolution (or is scientific at all in a philosophy of science sense), it is very possible for creation-science still to be nonreligious in the constitutional sense. However, by establishing that creation-science is scientific through the affirmative scientific evidence and scientific interpretations that constitute creation-science, we demonstrate that creation-science is not religious within the establishment clause's proscription.

a. Material Factual Issues that Creation-Science Is as Scientific as Evolution concerning the Origin of the Various Living Organisms

Definitions. The first aspect of creation-science and evolution is the origin of plants and animals. "Biological evolution"64/ or "organic evolution" describes the origin of living organisms through generally progressive change "from primordial life, through unicellular and multicellular organisms, invertebrate and vertebrate animals, to man . . .."65/ It postulates that all fish, amphibians, reptiles, birds, mammals, apes, man, and other organisms evolved from a common ancestor:

> The millions of diverse living species we find around us in the modern world

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64. E.g., T. Dobzhansky*, F. Ayala*, G. Stebbins*, & J. Valentine*, Evolution 129 (1977); N. Eldredge* & I. Tattersall*, The Myths of Human Evolution 3 (1982).

65. T. Dobzhansky*, Evolution, 10 Encyclopedia Americana _____ (19___).

> are all descended from a common ancestor that lived in the remote past (Fig. 1.1). The processes that have brought this diversity about are collectively called evolution.66/
>
> evolution. The process by which all organisms have arisen by descent from a common ancestor.67/

Biological creation describes the origin of plants and animals as through "abrupt appearance in complex form," as indicated by empirical evidence and scientific interpretation thereof.68/ It involves the abrupt appearance in complex form (creation) of all "natural groups,"68a/ which are usually

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66. F. Ayala* & J. Valentine*, Evolving: The Theory and Process of Organic Evolution 1 (1979) (college textbook).

67. S. Luria*, S. Gould* & S. Singer*, A View of Life 767 (1981) (college textbook).

68. Section 1[b] infra.

68a. The term "natural groups" represents the basic categories of organisms that transformed cladists currently seek to use, and that pre-Darwinian creationist scientists such as Linnaeus and Darwin's* contemporaries such as Agassiz sought to use, in classifying organisms. E.g., Patterson*, Cladistics, 27 Biologist 234, (1980)

genera or families (or sometimes species) of organisms.69/ The level varies because

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(Cladistics, "is about--the pattern in nature--groups, hierarchies or nested sets of groups, and characters of groups."); Charig*, Cladistics: A Different Point of View, in Evolution Now 121, 121 (J. Maynard Smith ed. 1982) ("Transformed Cladistics' is--natural order systematics'."). Leith*, Are the Reports of Darwin's Death Exaggerated?, 166 The Listerner 390, 391 (1981) ("The idea of common ancestry is necessarily theoretical, and one can either do taxonomy within that theoretical framework, believing that one is producing groups of common ancestry, or one can do it as it was done before Darwin, in a nonevolutionary framework, and believe one is finding what were then called 'natural groups.'").

69. This Brief uses "genus/family" to mean "genus or family" (depending on the particular organism), using the meanings in the International Code of Zoological Nomenclature and the International Code of Botanical Nomenclature.

The term "type," although not used with the same meaning as "family or genus," has been employed by some creationist scientists. E.g., 3 L. Agassiz, Contributions to the Natural History of the United States (1861); E. Shute, Flaws in the Theory of Evolution 5 passim (1961).

The term "type" also appears frequently in the scientific literature including leading evolutionist writings to refer to levels of classification. E.g., Mayr*, Evolution, Scientific American, Sept. 1978, at

generally accepted classification is some-

47, 49 ("Origin of higher types"); D. Raup* & S. Stanley*, Principles of Paleontology 126, 131 (2d ed. 1978); J. Huxley*, Evolution: The Modern Synthesis 562 (1942) ("a new type"); T. Dobzhansky*, Evolution, Genetics, and Man 2 (1955); F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 266 (1979) ("adaptive types"); E. Russell*, The Diversity of Animals 1, 71 passim (1962) ("horse types"; "major adaptive types"; etc.); W. Stansfield*, The Science of Evolution 78 passim (1977); A. Boyden*, Perspectives in Zoology 27 passim (1973) ("major types evolved from other major types"); I. Lerner*, The Genetic Basis of Selection (1958); M. Simon*, The Matter of Life: Philosophical Problems of Biology 166 (1971); A. Clark*, The New Evolution 235-36 (1930) ("all other animal types"); A. Romer*, Vertebrate Paleontology 15 (3d ed. 1966); P. Teilhard de Chardin*, The Appearance of Man 31 (J. Coehn trans 1965); Biological Science Curriculum Study*, Biological Science: Molecules to Man 369 passim (3d ed. 1973 & 1976); Monotremes*, 12 Encyclopaedia Britannica 384 (15th ed. 1974); Brady*, Dogma & Doubt, 17 Brit. J. Linnean Society 79, 80, 90 (1982); Martin*, A Non-Geneticist Looks at Evolution, 41 Am. Scientist 100, 100 (1953); Manser*, The Concept of Evolution, 40 Philosophy 18, 27 (1965); Gliedman*, Miracle Mutations, Science Digest, Feb. 1982, at 90, 91 ("every major type of . . . plant and . . . animal"); Gould* and Eldredge*, Punctuated Equilibria: The Tempo and Mode of Evolution Reconsid-

what subjective above the species level.70/

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ered, 3 Paleobiology 147, ___(1977) ("basic morphological types"); Stanley*, A Theory of Evolution above the Species Level, 72 Proc. National Academy of Science 646, 646 (1975) ("types of individuals are favored" by natural selection).

The generally accepted scientific use of "type" includes "type species," "type genera," "monotypic," "paratypes," "holotype," "lactotype," "syntype," "reotype," "plesiotypes," and "topotype." D. Raup* and S. Stanley*, Principles of Paleontology 113, 131 (2d ed. 1978).

70. W. Stansfield*, The Science of Evolution 510-11 (1977)("higher categories (genera, families, orders, classes, phyla, and even kingdoms), though they do represent greater levels of evolutionary divergence, are still artificial groupings made by humans for convenience in taxonomic work. They are not natural groupings the way that species are."). Accord, D. Raup* & S. Stanley*, Principles of Paleontology 135, 136, 138 (2d ed. 1978) ("The family, on the other hand, has no comparable objective basis. Higher categories are used to express evolutionary relationships but we do not have, in the present state of our understanding, specific rules that can be applied. In other words, there are no thresholds in the transition from genus to family comparable to the threshold between the subspecies and the species (at a single moment in time)."); Richards*, Book Review, 167 Science 1477, 1477 (1970) ("I think nearly all biologists must share, the species, is the only taxonomic category that has at least in more

Summary. This scientific evidence supporting biological creation is summarized in Subsection (1), and the noncompelling status of biological evolution is outlined in Subsection (2). The errors of the McLean decision about these explanations are outlined in Subsection (3) below.

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favorable examples a completely objective existence. Higher categories are all more or less a matter of opinion."); N. Macbeth*, Darwin Retried ____(1971).

(1) Empirical Evidence for Biological Creation (of Living Organisms)

Overview. Biological creation (defined above) consists of empirical evidence and scientific interpretations along at least six affirmative lines:

(a) Paleontology argument,
(b) Comparative morphology argument,
(c) Information content argument,
(d) Probability argument,
(e) Genetics argument, and
(f) Comparative unrelatedness argument.

In summary, (a) the paleontology argument is based on the abrupt appearance of complex organisms in the fossil record, and the systematic gaps between fossil organisms. (b) The comparative morphology argument is founded on the similar structure of even the oldest fossil organisms and their modern day counterparts, and the general non-change (stasis) of organisms from their first fossil appearance to the present or

to their extinction. (c) The information content argument concerns the vast information content of the least complex as well as the most complex living organisms and their complex parts, and the consequent necessity for creation of that information content. (d) The probability argument is based on the great mathematical probability of creation, and the infinitely small probability of evolution, of complex features, of complex molecules, and of organisms with symbiotic relationships. (e) The genetics argument is founded on the genetic limits on viable change or transformation of

*Note: Scientists cited in this Section (1), unless otherwise indicated, are not creationists, and their quoted statements are not intended as endorsements of creation-science. However, their quoted statements are acknowledging data that creationist scientists interpret as supporting creation-science better than evolution-science.

genera/families of organisms. (f) Finally, the comparative unrelatedness argument involves the evidence for distinct ancestry rather than common ancestry of genera/families of organisms, in the form of widespread anomalies in the comparative fields of systematics, anatomy, biochemistry, and other areas. These arguments, discussed in sequence, are material factual issues.

Historical Foundation. These affirmative evidences for creation-science are not newly formulated. In fact, they were advocated nearly 125 years ago by Professor Louis Agassiz of Harvard, who is described as "America's leading biologist" of the time by Gould* and as making "reputable claims" by Eldredge*.71a/ Agassiz wrote as follows

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71a. Gould*, Catastrophe and Steady State Earth, Natural History, Feb. 1975, at 15, 15-16; Eldredge* & Gould*, Punctuated Equilibria: An Alternative to Phyletic Gradualism, in Models in Paleobiology 82, 96 (J. Schopf ed. 1972).

of the (a) paleontology argument of abrupt appearance and systematic gaps, (b) comparative morphology argument, (c) information content argument, (d) probability argument, and (e) genetics argument:

> [a] Species appear suddenly and disappear suddenly in progressive strata. That is the fact proclaimed by Palaeontology . . ..
>
> . . ..
>
> The geological record, even with all its imperfections, exaggerated to distortion, tells now, what it has told from the beginning, that the supposed intermediate forms between the species of different geological periods are imaginary beings, called up merely in support of a fanciful theory.
>
> [b] But it stands recorded now as before, that the animals known to the ancients are still in existence, exhibiting to this day the characters they exhibited of old.
>
> [c] [Mr. Darwin] has lost sight of the most striking of the features, and the one which pervades the whole, namely, that there runs throughout Nature unmistakable evidence of thought, corresponding to the mental operations of our own mind, and therefore intelligible to us as thinking beings, and unaccountable on any other basis than that they owe their existence to the working of intelligence; and no theory

that overlooks this element can be true to nature.

[d] [Mr. Darwin] would also have us believe that the most perfect organs of the body of animals are the product of gradual improvement, when eyes as perfect as those of the Trilobites are preserved with the remains of these oldest animals.

[e] What ought to be shown, if the transmutation theory is to stand, is that these favored individuals diverge from their specific type, and neither Darwin nor any body else has furnished a single fact to show that they go on diverging.

The fact is that throughout all geological times each period is characterized by definite specific types, belonging to definite genera, and these to definite families, referable to definite orders, constituting definite classes and definite branches, built upon definite plans.

The origin of all the diversity among living beings remains a mystery as totally unexplained as if the book of Mr. Darwin had never been written, for no theory unsupported by fact, however plausible it may appear, can be admitted in science.71b/

71b. 3 L. Agassiz, Contributions to the Natural History of the United States (1861) (reprinted in 30 Am. J. Science, 142, 144-54 (1860)). Of course, the speci-

An Agnostic physicist, to whom creation-science is "anathema," recently concluded that the scientific evidence better supports it than evolution:

> I think however that we must go further than this and admit that the only acceptable explanation is creation. I know that this is anathema to physicists, as indeed it is to me, but we must not reject a theory that we do not like if the experimental evidence supports it.71c/

A recent commentator who strongly opposes creation-science has conceded that it can be scientific:

> Although, in the final analysis, creationism may prove to be ill founded,

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fic theories of genetics and information content were developed subsequently, but Agassiz pointed toward the concepts in his references to biological limits and intelligent structure. Modern creationist scientists do not agree with Agassiz that genetic limits apply at the species level, but instead place those limits at the family or genus level depending on the organism.

71c. Lipson, A Physicist Looks at Evolution, 31 Physics Bulletin _____, _____ (1980).

> it could, nevertheless, be put forward in a scientific spirit if it were presented merely as a model that accommodated the fossil data.71d/

A noted philosopher of science, although violently rejecting creation-science, has similarly acknowledged that it makes scientific, testable, falsifiable, "empirical claims," in criticizing the McLean decision:

> By arguing that the tenets of Creationism are neither testable nor falsifiable, Judge Overton (like those scientists who similarly charge Creationism with being untestable) deprives science of its strongest argument against Creationism. Indeed, if any doctrine in the history of science has ever been falsified, it is the set of claims associated with "creation-science." Asserting that Creationism makes no empirical claims plays directly, if inadvertently, into the hands of the creationists by immunizing their ideology from empirical confrontation. The correct way to combat Creationism is to confute the empirical claims it does make, not to pretend that it makes no such claims at all.71d/

71d. Comment, Evolution and Creationism in the Public Schools, 9 J. Contemp. Law 81 (1983).

71d. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 17 (1982).

The following Sections discuss affirmative evidences or empirical claims offered by creation-science.

(a) Paleontology Argument for Biological Creation.72/ The fossil record generally reflects two things: (i) the abrupt appearance of genera/families of complex organisms and (ii) the systematic gaps between different genera/families of fossil organisms. These two factors support biological creation and render biological evolution less plausible.

The systematic abrupt appearance of complex life and the systematic gaps between living forms have been acknowledged by such leading evolutionist scientists as Gould*, Raup*, Stanley*, and Simpson*, as well as by many others quoted in following para-

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72. "Paleontology" is the scientific study of fossils. The evolutionary argument is discussed in Section 2[a](2)(c)(i) infra.

graphs:

> Increasing diversity and multiple transitions seem to reflect a determined and inexorable progression toward higher things. But the paleontological record supports no such interpretation. There has been no steady progress in the higher development of organic design. We have had, instead, vast stretches of little or no change and one evolutionary burst that created the entire system.73/
>
> New species almost always appeared suddenly in the fossil record with no intermediate links to ancestors in older rocks of the same region.74/

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73. Gould*, The Five Kingdoms, Natural History, June-July 1976, at 30, 37.

74. Gould*, Evolution's Erratic Pace, Natural History, May 1977, at 12, 12.

> Unfortunately, the origins of most higher categories are shrouded in mystery; commonly new higher categories appear abruptly in the fossil record without evidence of transitional ancestral forms.75/

> In spite of these examples, it remains true, as every paleontologist knows, that most new species, genera, and families and that nearly all new categories above the level of families appear in the record suddenly and are not led up to by known, gradual, completely continuous transitional sequences.76/

The reason for abrupt appearances and gaps is not the "imperfection of the fossil record." With over 200,000,000 catalogued specimens of about 250,000 fossil species, many evolutionist paleontologists such as

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75. D. Raup* and S. Stanley*, Principles of Paleontology 382 (2d ed. 1978).

76. G. Simpson*, The Major Features of Evolution 360 (1953). Accord, Goldschmidt*, Evolution, as Viewed by One Geneticist, 40 Am. Scientist 84, 97 (1952) ("When a new phylum, class, or order appears, there follows a quick, explosive (in terms of geological time) diversification so that practically all orders or families known appear suddenly and without any apparent transitions.").

Stanley*, and others argue that the fossil record is sufficient:

> In part, the role of paleontology in evolutionary research has been defined narrowly because of a false belief, tracing back to Darwin and his early followers, that the fossil record is woefully incomplete. Actually, the record is of sufficiently high quality to allow us to undertake certain kinds of analysis meaningfully at the level of the species.77/

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77. S. Stanley*, Macroevolution 1 (1979). Gould*, Eldredge* and Tattersall*, and Kitts* make similar arguments:

> Gradualists usually extract themselves from the dilemma by invoking the extreme imperfection of the fossil record --if only one step in a thousand survives as a fossil, geology will not record continuous change. Although I reject this argument . . ..

Gould*, The Return of Hopeful Monsters, Natural History, June-July 1977, at 22, 24.

> One hundred and twenty years of paleontological research later, it has become abundantly clear that the fossil record will not confirm this part of Darwin's predictions. Nor is the problem a miserably poor record. The fossil record simply shows that this prediction was wrong.

N. Eldredge* and I. Tattersall*, The Myths of Human Evolution 45-46 (1982).

> Darwin also holds out the hope that some of the gaps would be filled as the

There are some instances where the fossil record is perfectly continuous for periods dated at ten million years, and in which organisms still "appear suddenly with no intermediate forms."78/ The reason for

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result of subsequent collecting. But most of the gaps were still there a century later and some paleontologists were no longer willing to explain them away geologically.

Kitts*, Paleontology and Evolutionary Theory, 30 J. Paleontology 458, 467 (1974); see also D. Raup* and S. Stanley*, Principles of Paleontology 303 (2d ed. 1978).

78. E.g., E. Ambrose*, The Nature and Origin of the Biological World 118 (1982):

Professor Hallam of Birmingham carried out a systematic study of bivalve shell fish found in successive layers of strata formed during the Jurassic period at Lyme Regis. These deposits were laid down by a continuous process in the Jurassic seas, so there were no gaps in the record. Hallam hoped to demonstrate the operation of natural selection leading to progressive changes in individual species. He ended up with a completely contrary conclusion, that individual species appear suddenly with no intermediate forms. They persisted for up to ten million years unchanged. Some continued longer, others disappeared, the basic pattern always showing fixity of species. A

abrupt appearances and gaps is similarly not the smallness of populations where evolution presumably occurs, because such populations would not remain small for thousands of years, as noted by Ayala*.79/

These systematic abrupt appearances and

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similar conclusion was reached by Eldredge, working in the American Museum of Natural History, who studies trilobites, the marine organisms which look rather like modern woodlice. Here again species persisted unchanged for millions of years and new species arose suddenly with no apparent linkage to previous forms.

79. E.g., F. Ayala* and J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 266-67 (1979).

It is not reasonable to expect these lineages to have small population sizes (and certainly not to be poorly adapted) for such a long time. Furthermore, even a rare lineage, if skeletonized, should appear in the fossil record sooner or later if it persisted for such a long period.

Instead, "there seems, over the years, to have arisen in paleontology a notion which, put cynically, claims that wherever in the fossil record one is looking happens to be where rapid phyletic evolution is not recorded"! S. Stanley*, Macroevolution 39, 88 (1979).

systematic gaps in the fossil record are an affirmative evidence in support of creation-science. Thompson* and Clark* both recognize that:

> Rather than supporting evolution, the breaks in the known fossil record support the creation of major groups with the possibility of some limited variation within each group.80/
>
> On the basis of the paleontological record, the creationist has the better of the argument.81/

Darwin recognized the critical problem for evolution posed by "The Sudden Appearance of Whole Groups of Allied Species" (one chapter in his Origin of Species) and by the systematic absence of "intermediate links."82/

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80. A. Thompson*, Biology, Zoology, and Genetics: Evolution Model vs. Creation Model 2, 76 (1983).

81. Clark*, Animal Evolution, _____ Quarterly Review of Biology ____(1928). Dr. Austin A. Clark* was curator of paleontology at the Smithsonian Institution.

82. Raup*, Conflicts Between Darwin and Paleontology, 50 Field Museum of Natural History Bulletin 22, 23 (1979).

One evolutionist author observes that "today it is the conventional neo-Darwinians who appear as the conservative bigots and the unorthodox neo-Sedgwickians [creationist-scientists] who rate as enlightened rationalists prepared to contemplate the evidence. 82a/ An example of a bigoted neo-Darwinian statement is made by evolutionist spokesman Futuyma*, that ". . . every fossil is consistent with the idea of evolution"! 82b/

> At one point [Darwin] observed, "innumerable transitional forms must have existed but why do we not find them embedded in countless numbers in the crust of the earth?"; in another place he said, "why is not every geological formation and every stratum full of such intermediate links? Geology assuredly does not reveal any such finely graduated organic chain, and this perhaps is the greatest objection which can be urged against my theory."

82a. Leach*, Men, Bishops and Apes, Nature, Sept. 3, 1981, at 19, 20.

82b. D. Futuyma*, Science on Trial 170 (1983). His paragraph begins with the question, "Why do biologists consider evolution to be a fact?" Id.

The fossil evidence contradicts him.

(i) The abrupt appearance of complex organisms in the fossil record has been noted by many noncreationist scientists such as Gould*, Ayala*, and Valentine*, who state:

> The history of most fossil species includes two features particularly inconsistent with gradualism:
>
> 1. Stasis. . . .
> 2. Sudden appearance. In any local area, a species does not arise gradually by the steady transformation of its ancestors; it appears all at once and "fully formed."83/

> Most orders, classes, and phyla appear abruptly and commonly have already acquired all the characters that distinguish them.

> We are forced to the conclusion that most of the really novel taxa that appear suddenly in the fossil record did in fact originate suddenly.84/

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83. Gould*, Evolution's Erratic Pace, Natural History, May 1977, at 13, 14.

84. F. Ayala* and J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 266-67 (1979).

Many other evolutionist scientists have published similar conclusions.85/ The major period of abrupt appearance is called the "Cambrian explosion":

> About 570 million years ago, our modern fossil record began with the

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85. E.g., S. Stanley*, Macroevolution 22 (1979) ("the fossil record seemed often to document sudden origins of higher taxa"); Gould*, Evolution: Explosion, Not Ascent, New York Times, Jan. 22, 1978, at ___ (most fossil species "enter the record abruptly"); N. Eldredge* and I. Tattersall*, The Myth of Human Evolution 8 (1982) ("Their sudden appearance alongside their unchanged ancestors reflects a common pattern in the geography of evolution."); Hanken* & Hall*, Evolution of the Skeleton, Natural History, Apr. 1983, at 28, 30 ("all four major skeletal tissue types appear more or less simultaneously in the fossil record."); Goldschmidt*, Evolution as Viewed by One Geneticist, 40 American Scientist 84, 97 (1952) ("practically all orders or families known appear suddenly and without any apparent transitions."); O. Schindewolf*, Grundfragen der Palantologie (1950); J. Rifkin*, Algeny 131 (1983) ("Plants and animal species show up suddenly in the rocks and then remain structurally the same for millions of years, until they become extinct.").

86. Gould*, The Ediacaran Experiment, Natural History, Feb. 1984 at 14, 14 (he sees the Edicaran fauna as the one excep-

> greatest of geological bangs--the Cambrian explosion. Within a few million years, nearly all major groups of invertebrates with hard parts made their first appearance in the fossil record. For fully three billion years before, life had been little more than a long sequence of bacteria and blue-green algae.86/

Vertebrate fish also appeared in the Cambrian explosion, so the explosion includes

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tion.). Accord, Gould*, In the Midst of Life . . ., Natural History, _____, at 34, 40; S. Stanley*, Macroevolution: Pattern and Process 67 (1979):

> When confronted with the abrupt appearance of many new families of a higher taxon, some workers have sought an explanation in the imperfection of the fossil record. The most general problem to which this approach has been taken is the apparently sudden appearance in the fossil record of the diverse classes of invertebrates that characterize the Cambrian system. In fact, it was Darwin, the first worker seriously faced with the "Cambrian problem," who . . . wrote in On the Origin of Species (1859, p. 308) "The case at present must remain inexplicable; and may be truly urged as a valid argument against the views [evolution by natural selection] here entertained."

Id. at 67. Accord, Gliedman*, Miracle Mutations, Science Digest, Feb. 1982, at 90, 91.

every major animal phylum.87/ And land plants appeared in this explosion.87a/

This abrupt appearance of complex life characterizes nearly every major category of organisms and every alleged stage in the evolutionary process. For invertebrates,88/ "all major invertebrate phyla appear sudden-

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87. E.g., Repetski*, A Fish from the Upper Cambrian of North America, 200 Science 529, 529 (1978) ("Anatolegis, interpreted as a heterostracan fish (class Agnatha), have been discovered in the Deadwood Formation of Late Cambrian age in northeastern Wyoming. This discovery extends back the age of the earliest known vertebrate fossils by approximately 40 million years. Other occurrences . . . show that these fish had a widespread geographic distribution in Late Cambrian and Early Ordovician marine environments.") N. Cygan* and F. Koucky*, The Cambrian and Ordovician Rocks of the East Flank of the Big Horn Mountains (1963).

87a. Axelrod*, Vascular Plants in the Cambrian, 13 Evolution 264, _____ (1959) ("The oldest land plants now known are the Early Cambrian of the Baltic region . . .. Approximately 60 Cambrian spore-genera are now on record . . ..").

88. "Invertebrates" are animals without backbones. "Vertebrates" are animals with backbones.

ly," and trilobites appear in an "explosion."89/ Fish appear abruptly in complex form in the fossil record, as noted by evolutionist authority Ommaney*:

> How this earliest chordate stock evolved, what stages of development it went through to eventually give rise to truly fishlike creatures we do not know. Between the Cambrian when it probably originated, and the Ordovician when the first fossils of animals with really fishlike characteristics appeared, there is a gap of perhaps 100 million years which we will probably never be able to fill. But in the 45 million years which followed, up to the Devonian when fishes experienced a veritable explosion in population and species, some very significant events took place which shaped their future for all time.90/

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89. W. Stansfield*, The Science of Evolution 75 (1977); Ager*, The Nature of the Fossil Record, 87 Proc. of Geological Association 131, 133 (1976).

90. F. Ommanney*, The Fishes 60 (1964). See also A. Romer*, Vertebrate Paleontology 15 (3d ed. 1966); White*, Presidential Address, 177 Proc. of Linnaean Society _____, 8 (1966). In fact, fish appeared before the Ordovician in the Cambrian period. Note 87 supra.

Amphibians and reptiles similarly appear abruptly in complex form.91/ Birds also appear abruptly in complex form in the fossil record.92/

Mammals appear abruptly in complex form, arising in an "explosion" summarized by Ager*:

> Other explosions, such as Cambrian trilobites or Tertiary mammals, are much more obvious. The latter are particularly interesting because they lay doggo for well over 100 million years before putting in their successful takeover bid.
>
> The point emerges that, if we examine the fossil record in detail whether at the level of orders or of species, we find--over and over again --not gradual evolution, but the sudden explosion of one group at the expense of another.93/

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91. See Patterson*, Book Review, 29 Systematic Zoology 216, 217 (1980); notes 73-85 supra.

92. E.g., see W. Swinton*, 1 Biology & Comparative Physiology of Birds 1 (A. Marshall ed. 1960); E. Russell*, The Diversity of Animals 118 (1962).

93. Ager*, The Nature of the Fossil Record, 87 Proc. of Geological Association 131, 133 (1976). Accord, G. Simpson*, Life

Primates appear abruptly in complex form in the fossil record, as acknowledged by evolutionist authority Johanson*:

> modern gorillas, orangutans, and chimpanzees spring out of nowhere, as it were. They are here today; they have no yesterday.94/

Man, finally, also appears abruptly in complex form.95/ For plants, the same thing

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Before Man 42 (1972) ("The most puzzling event in the history of life on earth is the change from the Mesozoic, Age of Reptiles, to the Age of Mammals. It is as if the curtain were rung down suddenly on a stage where all the leading roles were taken by reptiles, especially dinosaurs in great numbers and bewildering variety, and rose again immediately to reveal the same setting but an entirely new cast, a cast in which the dinosaurs do not appear at all, other reptiles are supernumeraries, and all the leading parts are played by mammals of sorts barely hinted at in the preceding acts."); see also G. Simpson*, Tempo and Mode in Evolution 105 (1944).

94. D. Johanson* & M. Edey*, Lucy: The Beginnings of Humankind 363 (1981). Accord, N. Eldredge* & I. Tattersall*, The Myths of Human Evolution 7-8 (1982) ("The remains of each of these new [hominid] species appear in the fossil record rather abruptly.").

95. E.g., see S. Zuckerman*, Beyond

is true: "vascular plants . . . arose almost simultaneously," and flowering plants made an "explosive" appearance.96/

Summary. Thus, plants and animals are characterized by an abrupt appearance of complex life throughout the fossil record. This directly supports biological creation, providing a material factual issue about the scientific nature of creation-science and evolution.

(ii) Systematic gaps between the higher categories of fossil organisms and between the various genera/families of organisms, also characterize the fossil record. "Gaps among known orders, classes,

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the Ivory Tower 64 (1970); Gould*, Evolution: Explosion, Not Ascent, New York Times, Jan. 22, 1978, at ____.

96. E.g., Gray* & Boucot*, Early Silurian Spore Tetred from New York: Earliest New World Evidence for Vascular Plants? 173 Science 918, 920 (1971); Ager*, The Nature of the Fossil Record, 87 Proc. of Geological Association 131, 133 (1976).

and phyla are systematic and almost always large," as Simpson* and others acknowledge.97/

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97. Simpson*, The Sudden Appearance of Higher Categories, in Evolution of Life 149 (S. Tax ed. 1960). "Phyla, classes, and orders" are general levels of classification below kingdoms and above families, genera, and species. Simpson* also writes:

> This regular absence of transitional forms is an almost universal phenomenon, as had long been noted by paleontologists. It is true of almost all orders of all classes of animals, both vertebrate and invertebrate. A fortiori, it is true also of the classes, themselves, and of the major animal phyla, and it is apparently also true of analogous categories of plants.
>
> Even apart from that, the recognition and interpretation of such discontinuities is interesting and is a necessary, frequently also a practical and useful, part of the paleontological profession. Moreover, it is a fact that discontinuities are almost always and systematically present at the origin of really high categories, and, like any other systematic feature of the record, this requires explanation.
>
> There remains, however, the point that for still higher categories discontinuity of appearance in the record is not only frequent but also systematic. Some break in continuity always occurs in categories from orders upwards, at

Yet, the absence of transitional forms to bridge these gaps is the "trade secret of paleontology," as Gould* states:

> The extreme rarity of transitional forms in the fossil record persists as the trade secret of paleontology. The evolutionary trees that adorn our textbooks have data only at the tips and nodes of their branches; the rest is inference, however reasonable, not the evidence of fossils.98/

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least, although the break may not be large or appear significant to most students.

G. Simpson*, Tempo and Mode in Evolution 107 (1944); G. Simpson*, The Major Features of Evolution 360-61 (1953). Patterson* reaches the same conclusion:

> But there are still great gaps in the fossil record. Most of the major groups of animals (phyla) appear fully fledged in the early Cambrian rocks (Fig. 43), and we know of no fossil forms linking them.

C. Patterson*, Evolution 133 (1978). Accord, E. Russell*, The Diversity of Animals 130 (1962); see T. Dobzhansky*, F. Ayala*, G. Stebbins*, & J. Valentine*, Evolution 325 (1977).

98. Gould*, Evolution's Erratic Pace, Natural History, May 1977, at 12, 14. Accord, Gould*, The Return of Hopeful Monsters, Natural History, June-July 1977, at 22, 24 ("All paleontologists know that the fossil record contains precious little in

In fact, "the [fossil] record fails to contain a single example of a significant transition."99/ Patterson* and other evolutionist scientists note this:

> I fully agree with your comments on the lack of direct illustration of evolu-

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the way of intermediate forms; transitions between major groups are characteristically abrupt."); Williamson*, _____, 293 Nature 441, _____ (1981) ("A persistent problem in evolutionary biology has been the absence of intermediate forms in the fossil record. Long-term gradual transformations in single lineages are rare and generally involve simple size increase or trial phenotypic effects.").

99. Woodruff*, 208 Science, 716, ____ (1980). There are virtually no intermediate forms between phyla. E. Russell*, The Diversity of Animals 58 (1962) ("Each of the great phyla of animals is built upon a structural plan quite different from that of the others. Their origin is unknown; between them there exist no true connecting links, and there is no likelihood of the direct transformation of one into another . . .."); G. Simpson*, Tempo and Mode in Evolution 105 (1944) ("On still higher levels, those of what is here called "megaevolution," the inferences might still apply, but caution is enjoined, because here essentially continuous transitional sequences are not merely rare, but are virtually absent.").

> tionary transitions in my book. If I knew of any, fossil or living, I would certainly have included them . . .. I will lay it on the line--there is not one such fossil for which one could make a watertight argument. The reason is that statements about ancestry and descent are not applicable in the fossil record. Is Archaeopteryx the ancestor of all birds? Perhaps yes, perhaps no: there is no way of answering the question. It is easy enough to make up stories of how one form gave rise to another, and to find reasons why the stages should be favoured by natural selection. But such stories are not part of science, for there is no way of putting them to the test.100/

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100. Letter from Dr. Colin Patterson* to Luther V. Sunderland* (Apr. 10, 1979). Accord, Gould* & Eldredge*, Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered, 3 Paleobiology 115, 147 (1977) ("At the higher level of evolutionary transition between basic morphological designs, gradualism has always been in trouble, though it remains the 'official' position of most Western evolutionists. Smooth intermediates between Bauplane are almost impossible to construct, even in thought experiments; there is certainly no evidence for them in the fossil record . . .."); Raup*, Conflicts between Darwin and Paleontology, Field Museum of Natural History Bull., Jan 1979, at 22, 25. ("we have even fewer examples of evolutionary transition than we had in Darwin's time."); Olson*, The Problem of Missing Links: Today and

(The small handful of alleged transitional forms are discussed in Section (2)[d] below.)

These systematic gaps support creation-science, and are very damaging if not fatal to macroevolution:

> Despite the bright promise that paleontology provides a means of "seeing" evolution, it has presented some nasty difficulties for evolutionists the most notorious of which is the presence of "gaps" in the fossil record. Evolution requires intermediate forms between species and paleontology does not provide them.101/

In fact, T. H. Huxley*, who was "Darwin's bulldog" and chief exponent, wrote that "if

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Yesterday, 56 Quarterly Review of Biology 405, 407 (1981) ("The absence of intermediates in the fossil record was well known during the 19th century.").

101. Kitts*, Paleontology and Evolutionary Theory, 30 J. Paleontology 458, 467 (1974). Accord, J. Moore*, Science as a Way of Knowing--Evolutionary Biology, 23 Am. Zoologist 1, 23 (1983) ("If the hypothesis of evolution, which assumes that all of today's species are the descendants of a few original forms, is true, there should have been connecting forms between the major groups (phyla, classes, orders).").

it could be shown that this fact [gaps between widely distinct groups] had always existed, the fact would be fatal to the doctrine of evolution."102/

The existence of systematic gaps between fossil genera/families is an affirmative evidence supporting creation-science, and not just a negative evidence against evolution. Gould* and Eldredge* acknowledged that "morphological gaps" and "stasis" (lack of change) are affirmative "classes of information," although they often have been "ignored by evolutionists as 'no data.'"103/

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102. T. Huxley*, Three Lectures on Evolution 619 (1882).

103. Gould* & Eldredge*, Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered, 3 Paleobiology 115, 116 (1977). They write further:

> We wanted to expand the scope of relevant data by arguing that morphological breaks in the stratigraphic record may be real, and that stasis is data--that each case of stasis has as much meaning for evolutionary theory as each example of change.

Johnson* notes that "[t]he almost universal absence of fully documented transitions between species (a key creationist argument) has recently been underlined by scientists like Eldredge* and Gould*."103a/

These systematic gaps, or systematic absences of transitional forms, occur at every major step in the alleged biological evolutionary process. The gap between microorganisms and the complex Cambrian invertebrate animals is the "major mystery of the history of life," according to Simpson*.104/ Dobzhansky*, Ayala*, Stebbins*,

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Id., at 116. Similarly, gaps over time constitute affirmative data, because they amount to stasis of two different organism categories.

103a. Johnson*, Creation, Evolution and Historical Geology, 78 S. African J. of Science 264, 267 (1982).

104. G. Simpson*, The Meaning of Evolution 18 (1949). Axelrod* elaborates on this gap:

> One of the major unsolved problems of geology and evolution is the occurrence of diversified, multicellular marine

and Valentine* similarly state that

> the gap between Protista and the animal kingdom, which according to the present treatment is synonymous with the Metazoa, is so great that the origin of Metazoa is still obscure.
>
> . . . .
>
> Although there is a good fossil record of the major groups that have well-mineralized skeletons, the origins and earliest evolution of the metazoa phyla

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> invertebrates in Lower Cambrian rocks on all the continents and their absence in rocks of greater age . . . Evolution preceded their appearance in the record. However, when we turn to examine the Precambrian rocks for the forerunners of these Early Cambrian fossils, they are nowhere to be found. Many thick (over 5,000 feet) sections of sedimentary rock are now known to lie in unbroken succession below strata containing the earliest Cambrian fossils. These sediments apparently were suitable for the preservation of fossils because they often are identical with overlying rocks which are fossiliferous, yet no fossils are found in them.

Axlerod*, Early Cambrian Marine Fauna, 128 Science 7, 7 (1958). This is significant because about a billion years is generally postulated by evolutionists as necessary for life to reach that early Cambrian level of complexity, and numerous fossils should have been deposited in such a vast time.

cannot be documented from fossil evidence.105/

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105. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 373, 397 (1977). Hoyle similarly observes:

> Over ten thousand fossil species of insects have been identified, over thirty thousand species of spiders, and similar numbers for many sea-living creatures. Yet so far the evidence for step-by-step changes leading to major evolutionary transitions looks extremely thin. The supposed transition from wingless to winged insects still has to be found, as has the transition between the two main types of winged insects, the paleoptera (mayflies, dragonflies) and the neoptera (ordinary flies, beetles, ants, bees).

F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 43 (1983). Ager* notes similar gaps among Brachiopods:

> It must be significant that nearly all the evolutionary stories I learned as a student . . . have now been 'debunked'. Similarly, my own experience of more than twenty years looking for evolutionary lineages among the Mesozioc Brachopoda has proved them equally elusive.

Ager*, The Nature of the Fossil Record, 87 Proc. of Geological Association 131, 132 (1976). Invertebrates are "largely immune to the 'poor fossil record' argument," because "these creatures, unlike the vertebrates, have records that for major segments of geologic time are widely distributed in space and are also well studied." S. Stanley*, Macroevolution 88 (1979).

A similar "gap of perhaps 100 million years" exists between invertebrates and the earliest chordate fish, as described by Ommaney*.106/ Paleontologist Romer* of Harvard writes:

> In sediments of late Silurian and early Devonian age, numerous fishlike vertebrates of varied types are present, and it is obvious that a long evolutionary history had taken place before that time. But of that history we are mainly ignorant.107/

A "broad evolutionary gap not bridged by fossil materials" appears between fossil fish and amphibians, as noted by Romer*.108/

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106. F. Ommaney*, The Fishes 60 (1964).

107. A. Romer*, Vertebrate Paleontology 15 (3d ed. 1966). White*, former president of the Linnaean Society, reaches a similar conclusion about fish generally and lungfishes particularly, about which he is an authority:

> Whatever ideas authorities may have on the subject, the lungfishes, like every other major group of fishes that I know, have their origins firmly based in nothing.

White*, Presidential Address, 177 Proc. of Linnaean Society ____, 8 (1966).

108. A. Romer*, Vertebrate Paleontolo-

Similar systematic gaps occur between fossil amphibians and reptiles.109/

Systematic gaps also exist between fossil reptiles and birds, so that "there is no fossil evidence of the stages through which the remarkable change from reptile to bird was achieved."110/ Systematic gaps persist between fossil reptiles and lower mammals, as noted by Russell* and others:

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gy 36 (3d ed. 1966). Accord, Romer*, Book Review, 162 Science 250, ____(1968)("The transition between the Paleozoic amphibians and the 'modernized' forms is almost completely a blank . . .."); Patterson*, Book Review, 29 Systematic Zoology 216, 217 (1980).

109. Section 2[a](2)(d)(vi) infra.

110. Swinton*, The Origin of Birds, in 1 Biology and Comparative Physiology of Birds 1 (A. Marshall ed. 1960). The first bird, which is essentially a modern bird, appears suddenly in the same Late Jurassic period as Archaeopteryx, which is alleged to be a reptile-bird intermediate (discussed below). E.g., The Oldest Fossil Bird: A Rival for Archaeopteryx?, ____ Science 284 (1978); Cracraft*, Phylogenetic Relationships and Monophyly of Loons, Grebes, and Hesperornithiform Birds, 31 Systematic Zoology 35, 53 (1982).

> "Missing links" have for the most part remained missing. Even in the Mammals, whose geological history is comparatively well documented, serious gaps in the record occur just at the time when the primary differentiation of the Orders is taking place. . . . A specially striking example is provided by the Bats. They appeared in the Middle Eocene with their wings fully differentiated, and since that time, some 5055 million years ago, the bat's wings have not essentially progressed, though they have become more diversified (Simpson, p. 119). The Bats, we must assume, have evolved, like the other mammalian Orders, from the primitive insectivores of Upper Cretaceous and Paleocene times, but of this great transformation, involving an entirely new mode of life, and a high degree of structural specialisation, we have so far no record. So also with the Whales, as we have already seen. Though in this case primitive forms are known, these are not ancestral to the modern whales, which are not linked to the primitive mammalian stock by any known intermediate forms.111/

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111. E. Russell*, The Diversity of Animals 123 (1962). Simpson* similarly notes the gaps between all 32 mammal orders:

> The earliest and most primitive members of every order already have the basic ordinal characters, and in no case is an approximately continuous series from one order to another known. In most cases the break is so sharp and the

Similar systematic gaps characterize the alleged transformation from lower mammals to primates: "In spite of recent findings, the time and place of origin of order Primates remains shrouded in mystery."111a/ Finally, systematic gaps prevail between fossil apes and man, as recognized by Zuckerman*:

> For example, no scientist could logically dispute the proposition that man, without having been involved in any act

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gap so large that the origin of the order is speculative and much disputed. G. Simpson*, Tempo and Mode in Evolution 105-06 (1944). Accord, S. Stanley*, Macroevolution 82 (1979) ("despite the detailed study of the Pleistocene mammals of Europe, not a single valid example is known of phyletic transition from one genus to another."); G. Simpson*, Life Before Man 42 (1972) ("The most puzzling event in the history of life on earth is the change from the Mesozoic, Age of Reptiles, to the Age of Mammals.").

111a. Simons*, The Origin and Radiation of the Primates, 167 Annals of New York Academy of Sciences 318 (1969). Accord, A. Kelso*, Physical Anthropology 142 (2d ed. 1974) ("the transition from insectivore to primate is not documented by fossils.").

> of divine creation, evolved from some ape-like creature in a very short space of time--speaking in geological terms --without leaving any fossil traces of the steps of the transformation.112/

Summary. Thus, the fossil record is characterized by systematic gaps between the higher categories and between the various genera/families of organisms, as well as by the abrupt appearance of complex life. This paleontology argument directly supports biological creation, and provides a material factual issue about the scientific nature of creation-science and evolution.

(b) Comparative Morphology Argument for Biological Creation. The comparative morphology115/ argument is based on (i) the

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112. S. Zuckerman*, Beyond the Ivory Tower 64 (1970). Accord, Gribben* & Cherfas*, Descent of Man--Or Ascent of Apes?, 91 New Scientist 592, 594 (1981) ("frailty of the conventional history of man and apes"); Gliedman*, Miracle Mutations, Science Digest, Feb. 1982, at 90, 90 ("No fossil or other physical evidence directly connects man to ape.").

115. "Morphology" means outward as-

systematically similar structure of fossilized organisms and their modern day counterparts, and (ii) the general nonchange (stasis) of organisms from their first fossil appearance to the present or to their extinction.

(i) The systematically similar structure of fossilized organisms and their modern day counterparts (if not extinct) is described by Grasse*, the "greatest of French zoologists":

> Biologists find it hard to admit that, in their basic structure, present living beings differ at all from those of the past. To begin with, such a supposition seems contrary to the scientific spirit. But facts are facts; no new broad organizational plan has appeared for several hundred million years, and for an equally long time numerous species, animal as well as plant, have ceased evolving.116/

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pects or structure. "Comparative morphology" involves the comparison of fossil organisms and living organisms.

116. P. Grassé*, Evolution of Living Organisms 84 (trans. 1977). Accord, N. Macbeth*, Darwin Retried 121 (1971):

Many examples can be given. "Among single-celled organisms, the discovery, during the past decade, of survivors from a very remote past has been equally remarkable, though here it is a matter of finding essentially modern forms as Precambrian fossils," including some dated at "1.9 billion years old."117/ Among invertebrates, fossil insect wings are often "essentially identical" to modern wings, and fossils of the mollusk Neopilina,

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> In hundreds of millions of years there must have been changes in climate, changes in the environment, new enemies, new parasites, new diseases. Yet these creatures, without showing any special virtues or abilities, continue unchanged. Id. at 121.

117. Hutchinson*, Living Fossils, 58 American Scientist 534, _____ (1970). Accord, e.g., Reiser* & Tasch*, Investigations of the Viability of Osmophile Bacteria of Great Geological Age, 63 Trans. Kan. Academy of Science 31 (1960); Dombrowski*, Bacteria from Paleozoic Salt Deposits, 108 Arnah of N.Y. Academy of Science 453 (1963) (fossil Bacillus circulans identical to modern Bacillus circulans).

the brachiopod Lingula, the horseshoe crab Limulus, many ants, and cockroaches are also virtually identical to modern forms. 118/ Among vertebrate fish, the coelacanth, bowfin fish, sturgeon, garfish, and sirens show

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118. E.g., F. Hoyle & N. Wickramasinghe, Evolution from Space 86, 89 (1981) ("It is particularly remarkable that no forms with the wings at an intermediate stage of development have been found. Where fossil insects have wings at all they are fully functional to serve the purposes of flight, and often enough in ancient fossils the wings are essentially identical to what can be found today. Nor are there intermediate forms between the two kinds of wings, those of the Paleoptera held aloft or permanently at the side as in mayflies and dragonflies respectively, and those of the Neoptera with a flexing mechanism enabling the wings to be folded back into a resting position across the abdomen."); Gliedman*, Miracle Mutations, Science Digest, Feb. 1982, at 90, 92 ("One of the most familiar of these species is the horseshoe crab. Three slightly different ancestral species connect today's horseshoe crab with a nearly identical creature that flourished in warm Triassic seas 225 million years ago."); J. Beerbower*, Search for the Past 168 (1960); Kuisinitz*, Cockroach: The Ancient Super-Pest, Science World, Feb. 4, 1983, at 12 (from Dr. Betty Faber, entomologist with American Museum of Natural History).

similar structure; and among amphibians and reptiles, the lizardlike Sphenodon and soft-shelled turtles have a close similarity between fossil and modern forms.119/ Among mammals, fossil and modern bats are very similar despite a period dated at over fifty million years, and opossums, pangolins, new world porcupines, tapirs, and aardvarks remain virtually the same.120/ This syste-

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119. E.g., Gliedman*, Miracle Mutations, Science Digest, Feb. 1982, at 90, 92.

120. E.g., E. Russell*, The Diversity of Animals 123 (1962)("A specially striking example is provided by the Bats. They appeared in the Middle Eocene with their wings fully differentiated, and since that time, some 50-55 million years ago, the Bat's wings have not essentially progressed, though they have become more diversified (Simpson*, p. 119). The Bats, we must assume, have evolved, like the other mammalian Orders, from the primitive insectivores of Upper Cretaceous and Paleocene times, but of this great transformation, involving an entirely new mode of life, and a high degree of structural specialisation, we have so far no record."); Mayr*, Discussion, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution ___, 58 (P. Moorehead* & M. Kaplan* eds. 1967) ("An Eocene

matic similarity affirmatively supports biological creation, and renders biological evolution less plausible. As one noted evolutionist scientist stated recently, "if the hypothesis of evolution is true, the species that lived in the remote past must be different from the species alive today."121/

(ii) The systematic stasis (general nonchange122/) of organisms from their first fossil appearance to the present (or to their extinction) is the other side of the coin of systematically similar structure. Stasis is described by Gould* as the general rule, and by Eldredge* and Tattersall* as "the most obvious single fact about bio-

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bat looks just like a modern bat."); Jepsen*, Early Eocene Bat from Wyoming, 154 Science 1333, 1333 (1966).

121. Moore*, Science as a Way of Knowing--Evolutionary Biology, 23 Am. Zoologist 1, 20 (1983).

122. Stebbins* & Ayala*, Is a New Evolutionary Synthesis Necessary?, 213 Science 967, 970 (1981).

logical evolution--nonchange":

> The history of most fossil species includes two features particularly inconsistent with gradualism:
>
> 1. Stasis. Most species exhibit no directional change during their tenure on earth. They appear in the fossil record looking much the same as when they disappear; morphological change is usually limited and directionless.
>
> 2. Sudden appearance 123/
>
> Expectation colored perception to such an extent that the most obvious single fact about biological evolution--nonchange--has seldom, if ever, been incorporated into anyone's scientific notions of how life actually evolves. If ever there was a myth, it is that evolution is a process of constant change.
>
> The data, or basic observations, of evolutionary biology are full of the message of stability. Change is difficult and rare, rather than inevitable and continual. Once evolved, species with their own peculiar adaptations, behaviors, and genetic systems are remarkably conservative, often remaining unchanged for several millions of years.124/

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123. Gould*, Evolution's Erratic Pace, Natural History, May 1977, at 13, 14. Accord, Gould*, The Promise of Paleobiology as a Nomothetic, Evolutionary Discipline, 6 Paleobiology 96, 103 (1980).

124. N. Eldredge* & I. Tattersall*, The Myths of Human Evolution 8 (1982). Ac-

In connection with stasis, it is important to note that no new phyla, classes, and orders of organisms have appeared for a period dated at tens of millions of years or more:

> The fact [is] that subsequently no new phyla have appeared, and no new classes and orders. This fact, which has been much ignored, is perhaps the most powerful of all arguments against Darwin's generalisation.125/

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cord, id. at 8 ("And this picture of stability for long periods, interrupted by abrupt change, is typical of the fossil record of all life."). Eldredge* and Tattersall*, like Gould*, do not mean to imply that there is no abrupt appearance of new species.

125. G. Taylor*, The Great Evolution Mystery 137-38 (1983). See also A. Boyden*, Perspectives in Zoology 35 (1973):

> All the major types of animals likely to leave fossils are represented in the early Paleozoic rocks. This period of evolution is therefore characterized as much by the conservation of change as by the changes themselves. . . . But so far as is known over this long period of time no insect and no arthopod has evolved any different pattern leading to another phylum. The evidences relating to the Age of Stabilization do lend themselves to interpretation on the Neo-Darwinian basis, all this evolution being subspeciational and completely graded in origin, and

Summary. This comparative morphology argument strongly supports biological creation, and generates a material factual issue about the scientific nature of creation-science and evolution.

(c) Information Content Argument for Biological Creation. The information con-content126/ argument is based on the vast information content of all organisms from the most complex to the least complex, and

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the gaps between species having been secondarily acquired.

Id. at 35.

126. "Information content" is a concept, within the field of information science, that measures the information contained in something and distinguishes it from a random sequence:

> Information theory can be applied to any situation involving messages. It follows therefore that the language of life, the genetic code written along the lengths of DNA molecules in groups of three coding for the various twenty-two amino acids of proteins, can also be expressed in terms of a given amount of information.

E. Ambrose* , The Nature and Origin of the Biological World 125 (1982).

the corresponding necessity for biological creation of that information content and virtual impossibility of biological evolution of that information content. This information content can be considered (i) at the level of complex essential molecules and (ii) at the level of complex organs or other features.

(i) Complex molecules that are essential to particular organisms often have such a vast information content as to necessitate creation and to preclude evolution effectively. For example, the information content of essential enzymes is unimaginably vast, according to famous astronomer Hoyle and mathematician Wickramasinghe:

> The essence of his argument last week was that the information content of the higher forms of life is represented by the number 1040,000--representing the specificity with which some 2,000 genes, each of which might be chosen from 1020 nucleotide sequences of the appropriate length, might be defined. Evolutionary processes would,

> Hoyle said, require several Hubble times [each Hubble time is the time since the postulated big bang] to yield such a result. The chance that higher life forms might have emerged in this way is comparable with the chance that "a tornado sweeping through a junkyard might assemble a Boeing 747 from the materials therein".127/

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127. Hoyle on Evolution, Nature, Nov. 12, 1981, at 105, 105. Hoyle gives a simplified explanation:

> In total there are perhaps 2,000 such enzymes, and their structures are basically the same across the whole of the living world--an enzyme from a bacterium can be used in the cell of a man. The chance of finding each individual enzyme by stringing together amino acid beads at random is again like the Rubik cube being solved by a blindfolded person. Although the chance of finding all the enzymes, 2,000 of them, by random processes is not nearly as small as the chance of finding the whole 200,000 proteins on which life depends, the chance is still exceedingly minute. Call it [1040,000] x to 1 against. If you started to write x out in longhand form, beginning with the digit 1 and adding zeros, you would have . . . about forty pages, some 40,000 zeros in all.

F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 16-17(1983). Accord, F. Hoyle & N. Wickramasinghe, Evolution from Space 129 (1981). The counterargument that enzymes in early life were shorter is not persuasive. Id. at 129.

Another example is the information content of the DNA and RNA of genes, which is vast for all organisms:

> The primitive RNA strands that happened to have the right backbone and the right nucleotides had a second and crucial advantage. They alone were capable of stable self-replication. They were simultaneously both the source of instruction (through the base-pairing rules) and the target molecules to be synthesized according to that instruction. Here at the molecular level are the roots of the old puzzle about the chicken or the egg. Which came first, function or information? As we shall show, neither one could precede the other; they had to evolve together.128/

The precise sequence of nucleotides in DNA and RNA, and of amino acids in proteins, has a vast information content for various organisms.

(ii) Complex organs and other features

(Hoyle and Wickramasinghe describe their scientific views as creationist views of a nontheistic and nonbiblical sort.)

128. Eigen*, et al., The Origin of Life, in Evolution Now ___, 13 (J. Maynard-Smith* ed. 1982).

also have an incredibly large information content that necessitates biological creation and effectively precludes biological evolution, particularly in view of the harmfulness of nearly all imaginable intermediate stages in their evolution. One example is the human brain, which has an information content (not counting information added to a person's memory) equivalent to 20,000,000 books, as astronomer Sagan* notes:

> The information content of the human brain expressed in bits is probably comparable to the total number of connections among the neurons--about a hundred trillion, 1014 bits. If written out in English, say, that information would fill some twenty million volumes, as many as in the world's largest libraries.128a/

A further example is the eye with its complex lens, retina, optical nerves, and other parts. Darwin* wrote in 1860 that "the eye to this day gives me a cold shudder,"129/

128a. C. Sagan*, Cosmos 278 (1980).

129. 2 C. Darwin*, The Life and Letters of Charles Darwin 67 (1887).

and explained his reasons as follows:

> To suppose that the eye, with all of its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest possible degree.130/

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130. C. Darwin*, The Origin of Species 160 (1859, reprinted in 1967). Accord., E. Mayr*, Systematics and the Origin of Species 296 (1942); M. Ghiselin*, The Triumph of the Darwinian Method 215-18, 221, 227-29 (1969). Any imaginable intermediate form in the biological evolution of the eye would be useless if not harmful, as Hardin* notes:

> How then are we to account for the evolution of such a complicated organ as the eye? . . . If even the slightest thing is wrong--if the retina is missing, or the lens opaque, or the dimensions in error--the eye fails to form a recognizable image and is consequently useless. Since it must be either perfect, or perfectly useless, how could it have evolved by small, successive, Darwinian steps?

G. Hardin*, Nature and Man's Fate 71-72 (1961). See also Gould*, The Return of Hopeful Monsters, Natural History, June-July 1977, at 22, 24-25. While Hardin* and some others have suggested that a flawed eye might have evolutionary value over no eye, the vast information content of the eye remains unaccounted for.

Further complicating the problem, the eyes of many different organisms seem to be totally unrelated.130a/

Another example is the feather with its vane, which is fringed with barbs, which in turn is fringed with barbules, which contain tiny hooks. Darwin* recovered from his problem with the eye but had malignant difficulty with the feather:

> I remember well the time when the thought of the eye made me cold all over, but I have got over this stage of the complaint, and now small trifling particulars of structure often make me very uncomfortable. The sight of a feather in a peacock's tail, whenever I gaze at it, makes me sick.131/

130a. E.g., 1 S. Duke-Elder*, System of Opthamology 178, 247 (19__); H. Neal* & H. Rand*, Comparative Anatomy 582 (1943).

131. C. Darwin*, The Life and Letters of Charles Darwin Vol. II 296 (1887). Accord, E. Mayr*, Systematics and the Origin of Species 296 (1942)("it is a considerable strain on one's credulity to assume that finely balanced systems such as certain sense organs (the eye of vertebrates, or the bird's feather) could be improved by random mutations."); M. Ghiselin*, The Tri-

Seventeen such inexplicable problems are listed by Goldschmidt*:

> hair in mammals; feathers in birds; segmentation of arthropods and vertebrates; the transformation of the gill arches in phylogeny; teeth; shells of mollusks; ectoskeletons; compound eyes; blood circulation; alternation of generations; statocysts; ambulacral system of echinoderns; pedicellaria of the same; cnidocysts; poison apparatus of snakes; whalebone; and primary chemical differences like hemoglobin versus hemocyanin.132/

Five similar marvels are listed by Russell*, a late president of the prestigious Linnaean Society, and eight others by Hardy*.133/ The co-founder of biological evolution, Al-

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umph of the Darwinian Method 215-16, 218, 221, 227-29 (1969).

132. R. Goldschmidt*, The Material Basis of Evolution 6-7 (1940). Goldschmidt* attempted to explain these complex structures by his "hopeful monster" hypothesis of huge-scale mutations. Virtually all biologists reject his hypothesis as impossible under genetic laws and information theory under natural processes.

133. Russell*, The Diversity of Mammals, 13 Acta Biotheoretica 1 (1962); A. Hardy*, [Mac] (1965).

fred Russell Wallace*, gave the example of the human brain as an organ so complex as to preclude evolution and require creation:

> A brain one-half larger than that of the gorilla would . . . fully have sufficed for the limited mental development of the savage; and we must therefore admit that the large brain he actually possesses could never have been solely developed by any of those laws of evolution, whose essence is, that they lead to a degree of organization exactly proportionate to the wants of each species, never beyond those wants . . . Natural selection could only have endowed savage man with a brain a few degrees superior to that of an ape, whereas he actually possesses one very little inferior to that of a philosopher.134/

The vast complexity and information content of python hinged jaws, warning colors, bee food dances, and spider webs are cited by Hoyle.135/

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134. A. Russell*, Natural Selection and Tropical Nature 202 (1895).

135. F. Hoyle & N. Wickramasinghe, Evolution from Space (1981):

> Many of these modifications possess an all-or-nothing character which makes it very difficult to understand

These complex organs or features until fully formed are generally of no evolution-

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how natural selection could have produced them. Thus the python's upper jaw is hinged, and this affords an advantage. The python possesses two curved, pointed fangs which sink into the prey and hold it while the python begins to swallow it. However, the teeth are set pointing backwards, so that they would never enter the victim's flesh, were it not for the hinge, which causes them to strike at a more obtuse angle than they otherwise would. This hinge was not of the slightest value until it formed and worked.

Id. at ____. Hoyle lists other examples:

Warning colours

Many animals like this ladybird and eyed hawkmoth use warning colours and false "eyes" to alarm preditors, or warn that they are inedible. But how useful would a rudimentary eye-spot or a weak warning colour be? The initial stages would be more of a handicap than an advantage.

Bee food dance

This waggling dance performed by worker bees communicates the location of a food source in an extremely precise way. The development of this system of coded messages by a gradual process is difficult to explain given the limited evolutionary time available.

. . . .

A spider's web

ary value and in fact are harmful, as noted by Gould*:

> Even though we have no direct evidence for smooth transitions, can we invent a reasonable sequence of intermediate forms, that is, viable functioning organisms, between ancestors and descendants? Of what possible use are the imperfect incipient stages of useful structures? What good is half a jaw or half a wing? The concept of "preadaptation" provides the conventional answer by permitting us to argue that incipient stages performed different functions. But a plausible story is not necessarily a true one, and, in any case, the issue is not, can preadaptation save gradualism in some cases, but rather, does it permit us to invent a tale of continuity in most or all cases? I submit, although it may only

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> Spiders construct a wide variety of webs, some of great complexity, and all by instinct. Yet a rudimentary web consisting of a few random strands is hardly likely to have trapped much food. How could today's precise structures have evolved by natural selection?

F. Hoyle, The Intelligent Universe 40 (1983). The house construction and food storage of the wasplike Eumenedes amedi provides another example. N. Macbeth*, Darwin Retried 71-72 (1971).

136. Gould*, The Return of Hopeful Monsters, Natural History, June-July 1977,

> reflect my lack of imagination, that the answer is no, and I invoke two recently supported cases of discontinuous change in my defense.136/

Darwin* recognized that biological evolution would be disproved, and biological creation would be supported, if such complex organs could not be explained by numerous small steps:

> If it could be demonstrated that any complex organ existed, which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down.137/

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at 22, 24-25. Accord, J. Rifkin*, Algeny 140 (1983)("In fact, upon close examination, virtually every fully operational system that exists within living things works only as an integrative unit, and the individual parts that make it up appear to exhibit absolutely no value on their own in advancing the survival of the individual or the species."). Preadaptation is listed by Taylor* as one of a "dozen areas where the theory of evolution by natural selection seems either inadequate, implausible, or definitely wrong.") G. Taylor*, The Great Evolution Mystery 138 (1983).

137. C. Darwin*, On The Origin of Species 189 (1859, repr. 1966). Although punctuated equilibria advocates attempt to explain these complex organs in fewer steps

The vast information content of complex molecules and of complex organs is affirmative evidence for biological creation and strong contrary evidence against biological evolution, as Hoyle and Wickramasinghe point out:

> From the beginning of this book we have emphasized the enormous information content of even the simplest living systems. The information cannot in our view be generated by what are often called 'natural' processes, as for instance through meteorological and chemical processes occurring at the surface of a lifeless planet. As well as a suitable physical and chemical environment, a large initial store of information was also needed.138/

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than Darwin did, and Neo-Darwinists do, still they must postulate many intermediate steps and many intermediate uses for such organs, in an equally implausible scenario.

138. F. Hoyle & N. Wickramasinghe, Evolution from Space 150 (1981). See also J. Maynard-Smith*, The Theory of Evolution 30-31 (1975) (". . . the fact of evolution was not generally accepted until a theory had been put forward to suggest how evolution had occurred, and in particular how organisms could become adapted to their environment; in the absence of such a theory, adaptation suggested design, and so implied

The subtitle of their book is "A Theory of Cosmic Creation."

Summary. This information content argument powerfully supports biological creation, and certainly provides a material factual issue about the scientific nature of creation-science and evolution.

(d) Probability Argument for Biological Creation. The probability argument is based on the high mathematical probability of creation, and the infinitely small probability of evolution, (i) of complex organisms, (ii) of complex molecules, and (iii) of symbiosis between various organisms.

(i) The mathematical probability of occurrence of complex organisms is high for biological creation and low for biological

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a creator."). Under Maynard-Smith's* analysis, just as complex adaptation suggests design by creation, vast information content of complex organs suggests an origin of that design by creation.

evolution. Schutzenberger* of the University of Paris, at a conference on "mathematical challenges to the Neo-Darwinian interpretation of evolution," concluded that the probability of evolution by mutation and natural selection is "not conceivable":

> We believe that it is not conceivable. In fact if we try to simulate such a situation by making changes randomly at the typographic level . . . on computer programs we find that we have no chance (i.e., less than 1/101000) even to see what the modified program would compute; it just jams.
>
> . . ..
>
> Thus to conclude, we believe that there is a considerable gap in the neo-Darwinian theory of evolution, and we believe this gap to be of such a nature that it cannot be bridged within the current conception of biology.141/

Eden* of Massachusetts Institute of Technology reached a similar conclusion of "high implausibility," and found the probability

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141. Schutzenberger*, Algorithms and the Neo-Darwinian Theory of Evolution, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution ____, 74-75 (P. Moorehead & M. Kaplan eds. 1967).

of evolution to be unimaginably small:

> If randomness is taken to mean that a uniform probability is assigned to each possible independent substitution or addition, the chance of emergence of man is like the probability of typing at random a meaningful library of one thousand volumes using the following procedure: Begin with a meaningful phrase, retype it with a few mistakes, make it longer by adding letters, and rearrange subsequences in the string of letters; then examine the result to see if the new phrase is meaningful. Repeat this process until the library is complete.142/

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142. Eden*, Inadequacies of Neo-Darwinian Evolution as a Scientific Theory, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution ___, 109-10 (P. Moorhead & M. Kaplan eds. 1967). He stated generally:

> It is our contention that if "random" is given a serious and crucial interpretation from a probabilistic point of view, the randomness postulate is highly implausible and that an adequate scientific theory of evolution must await the discovery and elucidation of new natural laws--physical, physico-chemical and biological.

Id. at 109. Taylor* lists, as one of twelve points rendering biological evolution "inadequate, implausible, or definitely wrong," the "repeated occurrence of changes calling for numerous coordinated innovations, both at the level of organs and of complete or-

Such small probabilities constitute impossibility under statistical rules.142a/

(ii) Of Complex Molecules. The probability of complex molecules is similar. For human protein, the probability of biological evolution of each one (of over 200,000 proteins) is "the same as those against a random solution of the Rubik cube" (less than 1 chance in 1 billion):

> These odds are roughly the same as you could give to the idea of just one of our body's proteins having evolved randomly, by chance. However, we use about 200,000 types of protein in our cells. If the odds against the random creation of one protein are the

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142a. E.g., E. Borel*, Probabilities and Life 28 (1962) ("We may be led to set at 10^{-50} the value of negligible probabilities on the cosmic scale. When the probability of an event is below this limit, the opposite event may be expected to occur with certainty, whatever the number of occasions presenting themselves in the entire universe."); G. Salet, Chance and Certainty: Evolution in the Light of Modern Biology (1972); Lafont, Book Review, Permanences, Nov. 1972, at 8; E. Borel*, Elements of the Theory of Probability 57 (1965).

> same as those against a random solution of the Rubik cube, then the odds against the random creation of all 200,000 are almost unimaginably vast.143/

For human blood types, the same improbability of biological evolution and probability of biological creation exist. Hemoglobin in blood contains two chains (alpha and beta), and evolutionists generally assume that one evolved from the other. Yet that transformation would require at least 120 point mutations, with a very low probability under evolutionary processes, according to Eden*.144/

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143. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 12 (1983).

144. Also, at least 34 of these mutations would require changes in two or three nucleotides of the DNA segment that codes for hemoglobin. Eden*, _____, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution ____, ____ (P. Moorhead & M. Kaplan eds. 1967). Yet the change of a single nucleotide usually has lethal or very harmful results; the change of one of the 574 amino acids in hemoglobin causes sickle-cell anemia. See Wald*, _____, in

(iii) The probability of symbiosis of organisms (mutually advantageous or necessary relationships) also is high for biological creation and low for biological evolution. One example is symbiosis of the yucca moth and yucca plant:

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id. at ____, 19.

Myoglobin is also part of blood, and evolutionists generally assume that hemoglobin evolved from myoglobin. Yet that would require many mutations, and the intermediate forms would be "unsatisfactory proteins":

> Such changes cannot happen all at once; they must occur in many stages, over a long period of time. The intermediate mutational forms, we would suppose, must be rather unsatisfactory proteins, with imperfect tendencies to form loose aggregates of monomers, but without the advantageous cooperative interactions of haemoglobin as we know it. They would be neither good myoglobin nor good haemoglobin, and the organisms that possessed such molecules would scarcely be expected to do well in the ordeal of natural selection.

Edsall*, _____, in Structural Chemistry and Molecular Biology at ___, 88 (A. Rich & N. Davidson eds. 1968).

If it were not for the strange behaviour of the moth, and the no less strange modifications of its palps, which allow of the collecting of the ball of pollen, it would only be possible in rare and exceptional cases for the yucca plant to set its seed. If it were not for the existence of the yucca plant, the moth Pronuba would not be able to live, for it is only on the seeds of the yucca that the young larvae can feed. The two species, plant and moth, are mutually helpful to each other. The moth has developed the obliging habit of collecting pollen and stuffing it down the stigma tube of the yucca flower. The yucca has developed the habit of producing a sufficient number of seeds to satisfy the needs of the moth and leaving enough over for its own purposes. I have used the word developed, but is it possible to imagine the external circumstance which would prompt the moth to so strange a method of behavior, or that would stimulate the development of so peculiar an organ as the tentacle on the maxillary palp? Are we not making a big assumption when we assume that the close-fitting pattern of fate, which is presented by the moth and the plant, is due either to environmental influences or to yet stranger and less accountable fortuitous mutations?

Is it not more honest to admit that our human reason, which is so much in love with a supposed relation between cause and effect, is staggered by the facts of this relationship?145/

Other examples are "the obligatory association between termites and the wood-digesting protists that inhabit the termite gut," which is "essential for the survival of the partners";146/ or the effect of the parasitic flatworm on ants, or the activities of the parasite-cleaning fish.147/

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145. E. Watson*, Enigmas of Natural History 50 (n.d.). Accord, M. Ghiselin*, The Triumph of the Darwinian Method 215-18, 221, 227-29 (1969); E. Mayr*, Systematics and the Origin of Species 296 (1942)("it is a considerable strain on one's credulity to assume that . . . the famous yucca moth case could result from random mutations.").

146. C. Patterson*, Evolution 162-63 (1978).

147. F. Hoyle, The Intelligent Universe (1983):

> The complex life of a parasite
> The parasitic flatworm, Dicrocoelim dendriticum, lives as a larva in snails and ants, and then matures in sheep. When attacking an ant, the larvae split up into two groups; a small number make for a particular nerve below the ant's mouth, paralyzing its jaws. The ant is then often stranded high up on a grass stem ready to be eaten by a passing sheep--a remarkable process difficult to explain by the haphazard modifications of evolutionary trial-and-error.

These probability considerations constitute affirmative evidence for biological creation, as well as serious weaknesses of biological evolution, as recognized by Hoyle and Wickramasinghe:

> Any theory with a probability of being correct that is larger than one part in 1040,000 must be judged superior to random shuffling. The theory that life was assembled by an intelligence has, we believe, a probability vastly higher than one part in 1040,000 of being the correct explanation of the many curious facts discussed in preceding chapters. Indeed, such a theory is so obvious that one wonders why it is not widely accepted as being self-evident. The reasons are psychological rather than scientific.148/

(Their subtitle is "A Theory of Cosmic Creation.") One aspect of the reason is that

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Cleaner fish
These brightly striped fish feed on parasites of larger species. Their "clients" do not attack them. How did this partnership evolve? The first cleaner to follow this behaviour would frequently have risked being eaten. Id. at 40.

148. F. Hoyle & N. Wickramasinghe, Evolution from Space 130 (1981).

most biological evolutionists, after excluding biological creation from consideration by psychological presupposition by definition, then fall prey to a "best-in-field fallacy" that ignores the improbability of biological evolution.149/

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149. Macbeth*, a noncreationist, summarizes the best-in-field fallacy:

> Darwinism has had to compete with various rival theories, each of which aimed to be a more or less complete explanation. . . . The Darwinians have shown that none of these theories are any good. . . . Thus the Darwinians are able to say that Darwin made a better try than anyone else, and they find real comfort in this.
>
> Does this mean that Darwinism is correct? No. Sir Julian Huxley says that, once the hypothesis of special creation is ruled out, adaptation can only be ascribed to natural selection, but this is utterly unjustified. He should say only that Darwinism is better than the others. But when the others are no good, this is faint praise. Is there any glory in outrunning a cripple in a foot race?
>
> . . ..
>
> It seems that the standards of the evolutionary theorists are relative or comparative rather than absolute. If such a theorist makes a suggestion that

Summary. The probability argument about complex features, complex molecules, and symbiosis supports biological creation, and provides another material factual issue about the scientific nature of creation-science and evolution.

(e) Genetics Argument for Biological Creation. The genetics argument is founded on the genetic limits on viable change or transformation of genera/families of organisms.149a/ Genes govern the structure

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is better than other suggestions, or better than nothing, he feels that he has accomplished something even if his suggestion will obviously not hold water. He does not believe that he must meet any objective standards of logic, reason, or probability.

N. Macbeth*, Darwin Retried 77-78 (1971). See also M. Ghiselin*, The Triumph of the Darwinian Method 215-18, 221, 227-29 (1969).

149a. This genetics argument is different from a concept of the "fixity of biblical kinds" or the "fixity of species," in that it is based on genetic laws and appied to genera usually rather than "kinds" or "species." However, the concept of fixity is not necessarily religious or nonscientific, as its history shows:

of an organism and limit variation in that structure. Genes do change by mutation.150/ However, (i) the restricted scope of viable mutations and (ii) the restricted frequency of viable mutations reflect genetic limits on viable change by

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> From Plato and Aristotle until Darwin the mainstream of western philosophers explained the orderliness and stability of the biological world by positing an immutable 'nature', 'form', or 'essence' for every organism that naturally breeds true. . . . The high-water mark of this Aristotelian philosophy of nature (though without Aristotle's metaphysical sophistication) was reached in the taxonomic labours of John Ray in the seventeenth century and Carolus Linnaeus in the eighteenth.

J. Moore*, The Post-Darwinian Controversies 206 (1979).

150. Mutations "can be classified in one of two major categories" gene (or point) mutations, which affect only one or a few nucleotides within a gene; and chromosomal mutations (or aberrations), which affect the number of chromosomes, or the number or the arrangement of genes in a chromosome." T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 57 (1977). Accord. S. Luria*, S. Gould* & S. Singer*, A View of Life 778 (1981).

macroevolution and instead produce the systematic gaps between genera or families of organisms and between higher categories of organisms. A similar argument for creation-science was made over a century ago by "the most eminent paleontologists" of Darwin's day.150a/

(i) Genetic limits on the scope of viable mutations are noted by zoologist Boyden* at Rutgers:

150a. Darwin* wrote in The Origin of Species:

> . . . the most eminent paleontologists, namely Cuvier, Agassiz, . . . etc. and all our greatest geologists, as Lyell, Murchison, Sedgwick, etc. have unanimously, often vehemently, maintained the immutability of species.

C. Darwin*, The Origin of Species 255 (1859, repr. 1967). Accord, Agassiz, Evolution and Permanence of Type, Atlantic Monthly, Jan. 1874, at 92; Agassiz, Synopsis of the Ichthyological Favor of the Pacific Slope, 19 Am. J. of Science and Arts 215, ____(1855). Modern creationist scientists do not argue that genetic limits occur at the species level, but at the family or genus level depending on the organism.

To focus attention on the known genetic units themselves, we see in multiple allelic series, that when genes mutate they generally continue to affect the same characters in similar ways, in other words, even genes are limited in their capacity for viable change. It is understandable, then, that since the beginnings of our fossil records, there appear to have been no major types evolved from other major types, such evolution, if it did occur, having taken place before the fixation of the original major phyletic types.

. . . .

The last 600,000,000 years show no revolutionary changes in the apparent mechanisms of evolution or in their products. All the major types of animals likely to leave fossils are represented in the early Paleozoic rocks. This period of evolution is therefore characterized as much by the conservation of change as by the changes themselves. It is evident that in the processes of establishing the major animal types, limits have been built into protoplasmic systems beyond which living patents cannot be extended. Of evolution by gradual variation leading to adaptive radiation there has been a great deal and in the Insecta for example almost infinite variability on a basic patent has taken place. . . . The evidences relating to the Age of Stabilization do lend themselves to interpretation on the Neo-Darwinian basis, all this evolution being subspeciational and completely graded in origin, and the gaps between species

having been secondarily acquired.151/

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151. A. Boyden*, Perspectives in Zoology 27, 35 (1973). Note that the "evolution" (really microevolution) that Boyden* points to is "subspeciational," meaning below the species level. Creationist scientists agree that subspeciational change occurs, and interpret the limited extent of such change as strong evidence for genetic limits on viable genetic change. Boyden* uses "type" in a sense broader than creationist scientists do. Rifkin* notes the genetic "upper and lower limits":

> The fruit fly has long been the favorite object of mutation experiments because of its fast gestation period (twelve days). X rays have been used to increase the mutation rate in the fruit fly by 15,000 percent. All in all, scientists have been able to "catalyze the fruit fly evolutionary process such that what has been seen to occur in Drosophila (fruit fly) is the equivalent of many millions of years of normal mutations and evolution." Even with this tremendous speed-up of mutations, scientists have never been able to come up with anything other than another fruit fly. More important, what all these experiments demonstrate is that the fruit fly can vary within certain upper and lower limits but will never go beyond them. For example, Ernst Mayr reported on two experiments performed on the fruit fly back in 1948. In the first experiment, the fly was selected for a decrease in bristles and, in the second experiment,

Grassé*, the "most distinguished of French zoologists" whose "knowledge of the living world is encyclopedic," 152/ similarly concludes that mutations have "no final evolutionary effect" because of genetic limits on the scope of viable ones. Mutations instead are

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for an increase in bristles. Starting with a parent stock averaging 36 bristles, it was possible after thirty generations to lower the average to 25 bristles, "but then the line became sterile and died out." In the second experiment, the average number of bristles was increased from 36 to 56; then sterility set in. Mayr concluded with the following observation:

> Obviously any drastic improvement under selection must seriously deplete the store of genetic variability. . . . The most frequent correlated response of one-sided selection is a drop in general fitness. This plaques virtually every breeding experiment.

J. Rifkin*, Algeny 134 (1983). Accord, N. Macbeth*, Darwin Retried 34 (1971)("Genetic homeostasis makes even micro changes look difficult, and seems to be a fatal obstacle to macroevolution.").

152. Dobzhansky*, Book Review, 29 Evolution 376, 376 (1975).

> merely hereditary fluctuations around a medium position; a swing to the right, a swing to the left, but no final evolutionary effect . . . they modify what pre-exists.153/

Further, many genes together govern most structures in an organism, so multiple beneficial mutations are required to bring a change of significant scope.154/ The genetic

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153. P. Grassé*, The Evolution of Living Organisms _____, 88 (trans. 1977). Russell* reaches a similar conclusion:

> 2. It would seem on the face of it that gene-mutations provide a very unpromising raw material for large scale evolution. Viable mutations are of the same order as the trivial differences between intra-specific races, and as such seem quite incapable of giving rise to the major divergences of structuro-functional organisation which characterise large scale habit and habitat specialisation and typal diversification. Such, however, is the faith which the Neo-Darwinians place in the efficacy of natural selection that they have no difficulty in believing that macro-evolution can be accounted for in principle by the same factors that bring about micro-evolution.

E. Russell*, The Diversity of Animals 123 (1962).

154. Ambrose* states:

> The difficulties in explaining the or-

limits on the scope of viable microevolution are dramatically shown by breeding experiments (artificial selection) and the sterility or reversion of breeds beyond a point.154a

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igin of increased complexity as a result of bringing a 'cluster' of genes together within the nuclei of a single organism in terms of probabilities, fade into insignificance when we recognise that there must be a close integration of functions between the individual genes of the cluster, which must also be integrated into the development of the entire organism. The improbability increases at an enormous rate as the number of genes increases from one to five. . . . The problem of bringing together the five mutated genes we are considering, within a single nucleus, and for them to 'fit' immediately into this vast complex of interacting units, is indeed difficult. When it is remembered that they must give some selective advantage, or else become scattered once more within the population at large, due to interbreeding, it seems impossible to explain these events in terms of random mutation alone.

E. Ambrose*, The Nature and Origin of the Biological World 123-24 (1982).

154a. Burbank, the greatest breeder of this century, acknowledged these genetic limits:

I know from my experience that I can

(ii) Genetic limits on the frequency of viable mutations have been acknowledged

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> develop a plum half an inch long or one 2-1/2 inches long with every possible length in between, but I am willing to admit that it is hopeless to try to get a plum the size of a small pea, or one as big as a grapefruit. . . . In short, there are limits to the development possible, and these limits follow a law. . . . [It is the law] of the reversion to the Average. . . . Experiments carried on extensively have given us scientific proof of what we had already guessed by observation; namely, that plants and animals all tend to revert, in successive generations, toward a given mean or average. . . . In short, there is undoubtedly a pull toward the mean which keeps all living things within some more or less fixed limitations.

W. Hall*, Partner of Nature _____ (1939). Accord, Deevy*, The Reply: Letter from Birnam Wood, 61 Yale Rev. 631, 636 (1967) ("Some remarkable things have been done by crossbreeding and selection inside the species barrier, or within a larger circle of closely related species, such as the wheats. But wheat is still wheat, and not, for instance, grapefruit; and we can no more grow wings on pigs than hens can make cylindrical eggs."); L. Erseley*, The Immense Journey 223 (1958) ("It would appear that careful domestic breeding, whatever it may do to improve the quality of race horses or cab-

by Hoyle, who notes the extreme infrequency of mutations in DNA copying:

> However, in actual cells the mistakes made when DNA is copied are far fewer than this, and mistakes like point mutations occur on average only once in each complete copying of the whole 200,000 chains. So instead of throwing up large numbers of natural mutations for natural selection to act upon, the copying of DNA seems to be remarkably accurate--not very helpful to the modern form of the Darwinian theory.155/

Even when mutations occur, one in a thousand or fewer is not lethal or harmful, and for most new structures at least several such mutations must occur or recombine in the

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bages, is not actually in itself the road to the endless biological deviation which is evolution."); D. Falcone*, Introduction to Quantitative Genetics 186 (1960) ("the improvements that have been made by selection in these [domesticated breeds] have clearly been accompanied by a reduction of fitness for life under natural conditions and only the fact that domesticated animals and plants do not live under natural conditions has allowed these improvements to be made.").

155. F. Hoyle, The Intelligent Universe 35 (1983).

same organism, as cell biologist Ambrose* notes.156/ The mutation then must become

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156. The probability is 1 in 1,000,000,000,000,000 that five mutations will occur in a single organism, or will occur in several organisms and then be recombined in a single organism in the ordinary case when the mutations are neutral and thus not subject to natural selection:

> The frequency with which a single non-harmful mutation is known to occur is about 1 in 1000. The probability that two favourable mutations would occur is 1 in 103 X 103, 1 in a million. Studies of Drosophila have revealed that large numbers of genes are involved in the formation of the separate structural elements. There may be 30-40 involved in a single wing structure. It is most unlikely that fewer than five genes could ever be involved in the formation of even the simplest new structure, previously unknown in the organism. The probability now becomes one in one thousand million million. We already know that mutations in living cells appear once in ten million to once in one hundred thousand million. It is evident that the probability of five favourable mutations occurring within a single life cycle of an organism is effectively zero. Let us consider the alternative possibility that the five mutations occur spontaneously within a large population of interbreeding organisms. They will have to be brought

established in the population of the organism, which takes on the average "10 million years" according to Wald*.157/

> together eventually in a single organism, if they are to generate the structure at a new level of complexity, favourable for natural selection.
>
> According to our definition, each of the genes we are considering is due to a mutation which will give rise to a hitherto unknown structure of additional complexity once it meets the other four genes in a single fertilised egg cell. It would indeed be surprising if any of these mutations could, at the same time, modulate an existing structure in a manner which would be selected favourably by natural selection. It is only when the five genes find themselves together that a selective advantage will merge. They are more likely to be present independently, within the population, as so-called neutral genes. . . . in the absence of a selective advantage the probability of the five genes coming together simultaneously within a single organism, will be extremely small.

E. Ambrose*, The Nature and Origin of the Biological World 120-21 (1982). Accord, J. Huxley*, Evolution in Action 41 (1953)(proportion of beneficial mutations is less than 1 in 1000); J. Kendrew*, The Thread of Life 106-07 (1966).

157. Wald*, Discussion _____, in Mathematical Challenges to the Neo-Dar-

Summary. Again, this genetics argument supports biological creation, producing the systematic gaps between genera or families of organisms and preventing macroevolution provides a material factual issue about the scientific nature of creation-science and evolution.

(f) Comparative Unrelatedness Argument for Biological Creation. Finally, the comparative unrelatedness argument involves the

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winian Interpretation of Evolution 19 (P. Moorehead* & M. Kaplan* eds. 1976):

> If you make a rough estimate . . ., it looks as if something of the order of 10 million years is needed to establish a mutation. That is, each of these single amino acid changes appears relatively frequently in individuals as pathology; but to establish one such change as a regular characteristic in a species seems to take something of the order of 10 million years.

Id. at 19. Accord, E. Dodson*, Evolution: Process & Product 225 (1960) (321,444 generations for a slightly beneficial recessive gene to increase frequency from 1 in 1,000,000 to 2 in 1,000,000).

evidence for distinct ancestry (biological creation) rather than common ancestry (biological evolution) of families/genera of organisms, in the form of widespread anomalies in the comparative fields of (i) classification, (ii) anatomy, and (iii) biochemistry and other areas. (Systematics,160/ comparative anatomy,161/ and comparative biochemistry162/ are three major arguments generally offered in favor of biological evolution.)

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160. "Classification" or "taxonomy" is "the theory and practice of naming, describing, and classifying organisms." W. Stansfield*, The Science of Evolution 98 (1977). The evolutionary argument is discussed at Section 2[a](2)(c)(iii) infra.

161. "Comparative anatomy" is the study of "genetic affinities as expressed in adult structures." Id. at 116. The evolutionary argument is discussed at Section 2[a](2)(c)(iv) infra.

162. "Comparative biochemistry" (or "molecular homology") is the study of similarities or "homologies at the molecular level," such as hemoglobin, cytochrome c, and insulin. Id. at 125. The evolutionary argument is discussed in Section 2[a](2)(c)(vi) infra.

(i) The data of classification support the distinct ancestry better than the postulated common ancestry of families/genera of organisms for several reasons. As a preliminary consideration, similarities between organisms, which cause them to be grouped together, only "imply shared characteristics . . . rather than common ancestry," as Patterson* points out.163/ First,

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163. He states in full:

> But it is possible to look at diagrams like Figure 3, and at the definitions Hennig associated with them, in a more general framework, one which has no evolutionary implications. Branching diagrams can be seen not as evolutionary trees, but as cladograms in which there is no time scale and the nodes imply shared characters (synapomorphies) rather than common ancestry.

Patterson*, Cladistics and Classification, New Scientist 303, 304 (1982). Thompson, the late Director of the Commonwealth Institute of Biological Control of Canada and a creationist scientist (Ph.D. in entomology), made this point with a good analogy in his Introduction to the 1956 edition of Darwin's Origin of Species:

> But not all the things that can be classified are connected by generation.

of the "three prevailing systems of classification,"164/ most of one school (cladis-

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> The arrangement of the chemical elements and their compounds is a true classification and so is the arrangement of geometric forms; yet no genealogical considerations are involved. . . . If we wish to erect a genealogical classification we cannot do so with a collection of abstractions drawn from our arrangement of existing organisms --we must discover through what forms the existing organisms have actually descended. If these historical facts cannot be ascertained, then it is useless to seek for substitutes, and from the fact that a classification is possible we certainly cannot infer that it is genealogical and is in any sense a proof of evolution.

Thompson, Introduction to C. Darwin, The Origin of Species at xvii (1956).

In fact, classification based on a presupposition of common descent is necessarily "highly speculative." J. Huxley*, Evolution: The Modern Synthesis 394-95 (1942). See also Ghiselin*, Models in Phylogeny, in Models in Paleobiology ___, 131 (T. Schopf* ed. 1972) ("many works on phylogeny do read like imaginative literature rather than science" and "fill gaps in data with speculations"); Bonner*, Book Review, 49 Am. Scientist 240 (1961) (phylogenies in textbooks "are, as a rule, a festering mass of unsupported assertions.").

164. T. Dobzhansky*, F. Ayala*, G. Stebbins* and J. Valentine*, Evolution 262 (1977). Accord, S. Luria*, S. Gould* & S. Singer*, A View of Life 684 (1981).

tics) and a large part of another school (phenetics) argue that classification is irrelevant to evolution. Within the transformed cladistic school, evolution is deliberately ignored, being considered unproven and possibly unprovable," according to Charig*.165/ Patterson* writes:

> cladistics is theoretically neutral so far as evolution is concerned. It has nothing to say about evolution. You don't need to know about evolution, or believe in it, to do cladistic analysis.166/

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165. Charig*, Cladistics: A Different Point of View, in Evolution Now 121, 121 (J. Smith 1982). Accord, Platnick*, Philosophy and the Transformation of Cladists, 28 Systematic Zoology 537, 537 (1979) ("neither the value nor the success of the methods is limited by the value or success of that evolutionary model.").

166. Patterson*, The Goals, Uses, and Assumptions of Cladistic Analysis (1981), cuoted in Beatty*, Classes and Clades 31 Systematic Zoology 25, 31 (1982). Accord, Ball*, On Groups, Existence and the Ordering of Nature, 32 Systematic Zoology 446, 446 (1983) (transformed cladists are "neutral or opposed to evolutionary theorizing of any kind," and "operate in a non-evolutionary domain"); Beatty*, Classes and Cladists, 31

Within the phenetics school, "some more radical numerical taxonomists have abandoned the goal of building a taxonomy that reflects evolutionary descent."167/ Second, from the history of classification, the system of classification was developed by Linnaeus on a creationist basis rather than an evolutionary basis,168/ and "the classification of organisms that existed before the advent of evolutionary theories has under-

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Systematic Zoology 25, 29, 31 (1982) ("cladists have taken more or less extreme measures to sever their ties" to evolutionary biology, and are "at odds with evolutionary thinking"); Patterson*, Cladistics and Classification ___ New Scientist 303, 304, 306 (1982)("Thus cladistics calls into question much of conventional evolutionary history."); Patterson*, Cladistics, 27 Biologist 234, ____ (1980) ("the evolutionary framework is inessential, and may be dropped.").

167. S. Luria*, S. Gould* & S. Singer*, A View of Life 676 (1981).

168. W. Stansfield*, The Science of Evolution 99 (1977). Accord, Dobzhansky*, Evolution, in 10 Encyclopedia Americana 734, 734 (1982) ("he did not interpret this propinquity as a consequence of common descent.").

gone surprisingly little change in the times following it," according to Mayr*.169/

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169. E. Mayr*, Systematics and the Origin of Species 276 (1942). He states further:

> The fact is that the classification of organisms that existed before the advent of evolutionary theories has undergone surprisingly little change in the times following it, and such changes as have been made have depended only to a trifling extent on the elucidation of the actual phylogenetic relationships through paleontological evidence. The phylogentic interpretation has been simply superimposed on the existing classification; a rejection of the former fails to do any violence to the latter. The subdivisions of the animal and plant kingdoms established by Linnaeus are, with few exceptions, retained in the modern classification, and this despite the enormous number of new forms discovered since then. The new forms were either included in the Linnaean groups, or new groups have been created to accommodate them. There has been no necessity for a basic change in the classification.

Id. Accord, Blackwelder*, Twenty-Five Years of Taxonomy, 26 Systematic Zoology 107, 134 (1977) ("Evolutionary taxonomy never has been really different from classical taxonomy, in spite of all the fireworks."); Simpson*, The Principles of Classification and the Classification of Mammals 85 Bull. Am. Museum of Natural History 4 (1945)("By substituting "common ancestor" for "archetype"

Third, of the two major sources of data considered in classification, "these two sources of information are often contradictory."170/ This widespread anomaly points

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the same classification could be considered phylogenetic or not, at will. The common ancestor was at first, and in most cases, just as hypothetical as the archetype, and the methods of inference were much the same for both, so that classification continued to develop with no immediate evidence of revolution in principles."); N. Macbeth*, Darwin Retried 20 (1971).

170. S. Luria*, S. Gould* & S. Singer*, A View of Life 763-64 (1981). Further, to the extent that classification supports evolution, this amounts to circular reasoning because, for the classical evolutionary school of taxonomy, "classifications are designed primarily, we are so often told, to 'state,' or 'reflect,' or 'be consistent with,' evolutionary and genetic relationships." Kitts*, Karl Popper, Verifiability and Systematic Zoology, 26 Systematic Zoology 185, 190 (1977). Accord, S. Gould*, Hen's Teeth and Horse's Toes 355 (1983). Thompson*, (an evolutionist) writes:

> In fact, there is circularity in the approach that first assumes some sort of evolutionary relatedness and then assembles a pattern of relations from which to argue that relatedness must be true. This interplay of data and interpretation is the Achilles' heel of the second meaning of evolution (3).

to distinct ancestry rather than common ancestry of the various families/genera of organisms. Finally, the very reason that classification of organisms is possible is

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Thompson*, Marginalia: The Meanings of Evolution 70 Am. Scientist 529, 529-30 (1982).

171. Systematic gaps are discussed in Section 2[a](1)(a)(ii) supra. This argument was part of the rationale for classification by its founder (Linnaeus), by "the greatest American biologist" at and just after the time of Darwin (Agassiz), and by the late Director of the Commonwealth Institute of Biological Control of Canada (Dr. W. R. Thompson), all of whom were creationist scientists. Thompson wrote:

> taking the taxonomic system as a whole, it appears as an orderly arrangement of clear-cut entities which are clear-cut because they are separated by gaps. These gaps Darwin explained by the hypothesis that the intermediates are constantly eliminated by natural selection. I do not think we can be expected to accept this unproved supposition as an argument for Darwinism. But in any case it has no bearing on the persistence throughout geological time, in spite of the fortuitous variation and natural selection, on the persistence of the fundamental anatomical plans exhibited by the great groups.

Thompson, Introduction to C. Darwin*, The Origin of Species at xvi-xvii (1956).

that systematic gaps exist between categories of organisms.171/

(ii) The data of comparative anatomy support the distinct ancestry of families/genera of organisms better than their postulated common ancestry because of several considerations. To begin, as with classification, similar anatomy does not necessarily indicate common ancestry or relatedness:

> such general resemblances in protoplasmic systems as we find in all living organisms do not necessarily mean genetic relationship. Rather, such resemblances may be fundamentally convergent, and represent only the minimum requirements or "conditions of existence" which all living systems must possess.172/

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172. A. Boyden*, Perspectives in Zoology 27 (1973). Accord, Patterson*, Significance of Fossils in Determining Evolutionary Relationships, 12 Ann. Rev. of Ecology and Systematics 195, 217 (1981)("Such hypotheses are untestable by morphology alone, which cannot discriminate descent from common ancestry, or from non-evolutionary relationship. Other assumptions (fossil record complete; evolution irreversible) are necessary to justify the hypothesis of descent, and may immunize it from direct test.")

First, the general absence of homologous (similar) genes for homologous structures (i.e., the general presence of nonhomologous genes) indicates unrelatedness rather than relatedness of different families/genera of organisms, as noted by Sir Gavin de Beer* in his book entitled Homology: An Unsolved Problem:

> It is now clear that the pride with which it was assumed that the inheritance of homologous structures from a common ancestor explained homology was misplaced; for such inheritance cannot be ascribed to identity of genes. The attempt to find homologous genes has been given up as hopeless . . . What mechanism can it be that results in the production of homologous organs, the same patterns, in spite of their NOT being controlled by the same genes: I asked this question in 1938, and it has not been answered. It is useless to speculate on any explanation in the absence of facts.
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> . . . .
>
> Therefore, homologous structures need not be controlled by identical genes, and homolgy of phenotypes does not imply similarity of genotypes.173/

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173. See G. de Beer*, Homology: An Unsolved Problem 15 (1971) (he does not argue

Second, anomalies are so widespread, in the form of homologies or similarities between groups that evolutionists believe are not closely related, that comparative anatomy better supports distinct ancestry than common ancestry of various families/genera of organisms. Evolutionists term these similarities "convergences," "parallelisms," "iterations," "analogies," etc. rather than homologies simply to reflect the presupposition that the organisms are not closely related.174/ Convergence is so

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that the absence of homologous genes indicates unrelatedness but merely the limited relevance of homologous anatomical features). See also Patterson*, Significance of Fossils in Determining Evolutionary Relationships, 12 Ann. Rev. of Ecology and Systematics 195, 208 (1981)(arguing that similar features (synapomorphies) "need have no evolutionary implications," according to transformed cladistics.).

174. Ayala* and Valentine* define these terms:

> On the other hand, some lineages that are only distantly related and that begin quite distinct morphologically

widespread that Patterson* says "convergence is everywhere," and Boyden* notes that "there are few kinds of characters which are not convergent in some groups."175/ Forey*

> may evolve so as to resemble each other closely. This is convergence and indicates that the separate lineages are becoming adapted to similar modes of life, usually in similar environments.
>
> Other patterns of resemblance between different lineages include parallelism, when two or more independent lineages change in similar ways so that their degree of resemblance remains about the same and iteration, when a given trait appears a number of separate times.
>
> . . ..
>
> When comparing different taxa of organisms, it has proven useful to distinguish between characters that resemble each other because they are desscended from a common ancestor, called homologous characters, and those that resemble each other because they have similar functions, called analogous characters.

F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 232 (1979). Accord, S. Luria*, S. Gould* & S. Singer*, A View of Life 645, 670-71 (1981).

175. Address of Dr. Colin Patterson*, American Museum of Natural History, tr. at 9 (Nov. 5, 1981); A. Boyden*, Perspectives

states that there are "repeated similarities between groups considered to be far apart by palaeontologists" that are categorized as "parallelisms, convergences, and so on."176/

Finally, as with classification, comparative anatomy was established by creationist scientists (Linnaeus etc.) and the term "homology" was introduced by a creationist scientist (Sir Richard Owen, the first Director of the British Museum) on

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in Zoology 27 (1973). Boyden*, a zoologist at Rutgers, lists examples:

> Multicellularity, symmetry, number of germ layers, presence of exoskeletons, paired-jointed appendages, wings, gills, sense organs, four-chambered hearts, constant body temperature, parthenogenesis, metagenesis, presence of hemoglobin, all these and many more characters appear to be convergent in some . . ..

Id.

176. Forey*, Neontological Analysis Versus Palaeontological Stories, in Problems of Phylogenetic Reconstruction 119, 149 (K. Joysey & A. Friday eds. 1982) (he is focusing on recent vertebrates).

the basis of distinct ancestry rather than common ancestry:

> Linnaeus, the father of systematic biology, named some 4,235 animal species and 5,250 plant species known to him. He regarded these species as primordial entities, made by the Creator in about the same state we find them now. Individuals of a species are, of course, not all alike, and there exist "varieties" (we would now call them "races") within species. To Linnaeus, varieties seemed unimportant deviations from the basic models of their species. He correctly recognized that man, apes, and monkeys resemble one another in body structures and placed them next to one another in his system of classification. However, he did not interpret this propinquity as a consequence of common descent.
>
> The science of comparative anatomy developed as a means of searching out these ideal plans, or archetypes.177/

The similarities between various genera/families of organisms (which creationist scientists acknowledge) are interpreted by

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177. Dobzhansky*, Evolution, in 10 Encyclopedia Americana 734, 734 (1982); C. Patterson*, Evolution 121-22 (1978). Accord, Patterson*, Cladistics and Classification, ___ New Scientist 303, 303 (1982).

creationist scientists to "reflect common requirements of engineering design" rather than common ancestry and relatedness.178/ Evolutionist scientists often acknowledge an engineering structure at the level of phyla and classes,179/ and creationist sci-

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178. Kenyon, The Creationist View of Biologic Origins, NEXA Journal, Spring 1984, at 28, 33 (A creationist scientist, Ph.D. from Stanford in biophysics.) The concept of "engineering constraints of good form" is also acknowledged by evolutionists in explaining convergence, natural selection, etc. E.g., S. Luria*, S. Gould* & S. Singer*, A View of Life 645 (1981). Accord, Gould*, Darwin's Untimely Burial _____ Natural History, _____ at _____(19__). The concept of "basic designs" is also acknowledged by evolutionists. E.g., Gould*, The Ediacaran Experiment, Natural History, Feb. 1984, at 14, 22 ("in honest moments we must admit that the history of complex life is more a story of multifarious variation about a set of basic designs than a saga of accumulating excellence."). Accord, A. Boyden*, Perspectives in Zoology 27 (1973) ("the minimum requirements or 'conditions of existence' which all living systems must possess").

179. E.g., A. Boyden*, Perspectives in Zoology 27 (1973); E. Russell*, The Diversity of Animals 58 (1962). Russell* states:

> Diversity of type meets us at the very

entists merely argue that the scientific evidence supports similar engineering structure down to the order, family, sometimes genus, and occasionally species levels.180/

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outset. Each of the great phyla of animals is built upon a structural plan quite different from that of the others. Their origin is unknown; between them there exist no true connecting links, and there is no likelihood of the direct transformation of one into another, as Vialleton in particular has so clearly pointed out (1929). They represent quite distinct modes of organisation, quite different solutions of the problems of moving, feeding and breathing.

Id.

180. For example, Agassiz (the "greatest American biologist" and professor of geology and zoology at Harvard) stated in 1860:

> Far from agreeing with these views [of Darwin*], I have, on the contrary, taken the ground that all the natural divisions in the animal kingdom are primarily distinct, founded upon different categories of characters, and that all exist in the same way, that is as categories of thought, embodied in individual living forms. I have attempted to show that branches in the animal kingdom are founded upon dif-

(iii) The data of comparative biochem-

> ferent plans of structure, and for that very reason have embraced from the beginning representatives . . . that exclude, as much as all the preceding distinctions, the idea of a common descent.

L. Agassiz, Contributions to the Natural History of the United States (1861) (modern creationist scientists do not follow his Platonic approach). Thompson* (Ph.D. in entomology and late Director of the Institute of Biological Control of Canada) similarly explains:

> What such cases like those of anatomical 'convergence' and general homology actually demonstrate is that there are large numbers of organisms, differing considerably in the details of structure but constructed on the same fundamental plan. However, this is no proof of descent from one original ancestor of this anatomical type.
>
> . . ..
>
> Therefore, the last thing we should expect on Darwinian principles is the persistence of a few common fundamental structural plans. Yet this is what we find. The animal world, for example, can be divided into some ten great groups or phyla, all of which are not morphologically as coherent and clear-cut as we might wish for convenience in classification, but nevertheless are stable and definable entities from the taxonomic standpoint. All identifiable animals that ever have existed can be placed in these groups. Generally

istry also point toward the distinct ancestry and away from the common ancestry of families/genera of organisms. As with other comparative approaches, similarity does not necessarily reflect common ancestry or relatedness.181/ Anomalies are so widespread between biochemical data and presumed common ancestry that they point to distinct ancestry. Studies of cytochrome c show two reptiles to differ more than a fish and a bird, than a fish and a mammal, or than an insect and a mammal, even though common ancestry assumes reptiles are closer to each other than those other pairs.182/ Research on a

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speaking, the subordinate groups are equally well defined.
Thompson, Introduction to C. Darwin*, The Origin of Species xvi-xvii (1956).

181. G. de Beer*, Homology, An Unsolved Problem 15 (1971); notes 163 and 172 supra.

182. Jukes* & Holmquist*, Evolutionary Clock: Nonconstancy of Rate in Different Species, 177 Science 530, 532 (1972)(the organisms were rattlesnake and turtle, lamprey

hormone indicates that amphibians are closer to mammals than reptiles or birds are to mammals, and that fish and reptiles are closer than fish and amphibians are, even though biological evolution postulates the reverse in each case.183/ Study of hemo-

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and chicken, dogfish and horse, screwworm fly and dog). Accord, Ayala*, The Mechanisms of Evolution, Scientific American, Sept. 1978, at 56, 68 ("The cytochrome c phylogeny disagrees with the traditional one in several instances, including the following: the chicken appears to be related more closely to the penguin than to ducks and pigeons; the turtle, a reptile, appears to be related more closely to birds than to the rattlesnake, and man and monkeys diverge from the mammals before the marsupial kangaroo separates from the placental mammals."). Similarly, research on cytochrome c showed mammals and amphibians, and mammals and insects, to be closer than three closely-related Pseudomonas bacteria. Ambler* & Wynn*, _____, 131 Biochemistry J. 485 (1973). Another study found "no correlation" for cytochrome c and evolution of some bacteria. Ambler* et al., Cytochrome c2 Sequence Variation Among the Recognised Species of Purple Nonsulphur Photosynthetic Bacteria, 278 Nature 659, 659 (1979).

183. King* & Millar*, Heterogeneity of Vertebrate Lutenizing Hormone-Releasing Hormone, 206 Science 67, 67 (1979)(the fish was the teleost).

globin shows that a reptile and a bird are more closely related than two reptiles are, and as closely related as man and a reptile, although common ancestry requires the opposite.184/ Research on insulin A indicates that man is closer to the rat and the sei whale than to sheep or goats, and that some fish are closer to mammals than to other fish, contrary to the requirements of common ancestry.185/ Other studies indicate that man is closer to apes than apes are to each other, and similar anomalies.186/ Re-

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184. Dr. Colin Patterson*, American Museum of Natural History, tr. at 7-9 (Nov. 5, 1981). Similarly, study of myoglobin shows that a bird and a reptile are closer than two reptiles to each other. Id. at 7-8.

185. R. Eck* & M. Dayhoff*, Atlas of Protein Sequence and Structure 110 (1966). Similar conclusions result from study of insulin B. Id. at 111. Different research with insulin shows that a fish and a mammal are closer than two fish are to each other. Schwabe Takes New Approach to Evolution, Catalyst, Oct. 13, 1983, at 7, 7 (dogfish shark, pig and carp).

search in numbers of chromosomes shows vast anomalies from the assumed course of evolution.187/ The anomalies are so widespread that biochemical comparisons do not support the common ancestry required by biological evolution, according to Hoyle and Wickramasinghe,188/ but instead point to the distinct ancestry postulated by biochemical creation.

Summary. This comparative unrelatedness argument is an affirmative evidence for biological creation, as Zihlman and Lo-

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186. Address of Dr. Colin Patterson*, American Museum of Natural History, tr. at 12-13 (Nov. 5, 1981) (man, chimp, gorilla, orangatan, and gibbon). Another researcher finds that a reptile is closer to a bird than to another reptile (turtle, bird, rattlesnake). Fitch* & Margoliash*, _____, 155 _____ 279 (1967).

187. Man has 46 chromosomes; a mammal (Florida mouse) has 48; a reptile (box turtle) has 50; a fish (goldfish) has 94; etc.

188. F. Hoyle & N. Wickramasinghe, Evolution from Space 82-84 (1981).

wenstein* acknowledge in reference to the comparative biochemistry evidence, saying that "this constitutes a kind of 'special creation' hypothesis."189/ The argument strongly supports biological creation, and offers a material factual issue about the scientific nature of creation-science and evolution.

Conclusion. Biological creation is scientific, not religious, and includes at least six scientific lines of argument. The paleontology argument shows the fossil record of systematic abrupt appearance and systematic gaps to support biological creation. The comparative morphology argument of systematic similarity between fossil organisms and their modern counterparts, and of systematic stasis, also points

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189. Zihlman* & Lowenstein*, False Start of the Human Parade, Natural History, Aug., 1979, at 86,90.

toward biological creation. The information content argument similarly shows vast information, in complex molecules and organs, that is best explained by biological creation. The probability argument concerns the high probability of biological creation of complex organisms, complex molecules, and symbiotic relationships. The genetics arcument focuses on the genetic limits on biological change. Finally, the comparative unrelatedness argument shows that classification, anatomy, and biochemistry better support distinct ancestry of genera/families of organisms through biological creation. These arguments affirmatively support biological creation and do not merely identify weaknesses of biological evolution. This aspect of creationscience is fully scientific. These are material factual issues.

(2) Noncompelling Status of Biological Evolution (of Living Organisms)

Definitions. "Biological evolution," which is sometimes called "organic evolution," is defined as follows by Ayala* and Gould* (ACLU expert witnesses):

> The millions of diverse living species we find around us in the modern world are all descended from a common ancestor that lived in the remote past. The processes that have brought this diversity about are collectively called evolution.191/

> Evolution: The process by which all organisms have arisen by descent from a common ancestor.192/

This definition of biological evolution, which includes evolutionary descent of all organisms from common ancestry, is the generally accepted definition. 193/ The term

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191. F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 1 (1979).

192. S. Luria*, S. Gould* & S. Singer*, A View of Life 767 (1981).

193. R. Oram*, Biology: Living Sys-

"biological evolution" is the generally ac-

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tems 118, 248-67, 277-94, 602-23, 73T-80T, 142T-45T (3d Ed. Teacher's ed. 1979) (high school text) ("evolved from a single, original, common ancestor."); J. Maynard-Smith*, The Theory of Evolution 152 (1958) ("The theory of evolution holds that existing plants and animals have originated by descent with modification from one or a few simple ancestral forms."); C. Patterson*, Evolution _____ (1978) ("The first is the general thesis that evolution has occurred --all animal and plant species are related by common ancestry . . ."); Thompson*, Marginalia: The Meanings of Evolution, 70 Am. Scientist 529, 529 (1982); W. Stansfield*, The Science of Evolution 3 (1977) ("Evolution is a scientific theory proposing that higher forms of life have descended from lower forms").

Note*: Scientists cited in this Section (2), unless otherwise indicated, are not creationists, and their quoted statements are not intended as endorsements of creation-science. However, their quoted statements are acknowledging data that creationist-scientists interpret as supporting creation-science better than evolution.

cepted term among scientists.194/

There are two general aspects to biological evolution: macroevolution and microevolution. These terms are defined by Gould* and by other evolutionist scientists as follows:

> macroevolution: Evolutionary change above the species level: e.g., long-term trends within lineages and mass extinctions.
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> microevolution: Evolutionary change within local populations, up to the origin of new species.195/

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194. E.g., F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 110 (1979); T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 129 (1977); G. Stebbins*, Darwin to DNA, Molecules to Humanity 7 (1982); Mayr*, Evolution, in Evolution at 2, 3 (E. Mayr ed. 1978); T. Dobzhansky*, Evolution, Genetics, and Man 2 (1955); Committee on Science and Creation*, Science and Creation: A View from the National Academy of Sciences 14 (1984); N. Eldredge* & I. Tattersall*, The Myths of Human Evolution 3 (1982); F. Ayala*, Biological Evolution: Natural Selection or Random Walk 62 Am. Scientist 692, ___ (1974).

195. S. Luria*, S. Gould* & S. Singer*, A View of Life 773, 774 (1981). Accord,

The "descent from a commmon ancestor" that forms the core of macroevolution involves evolution "from primordial life, through unicellular and multicellular organisms, invertebrate and vertebrate animals, to man . . .."196/ The terms "macroevolution" and "microevolution" are generally accepted and used by scientists.197/ Microevolution is

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Mayr*, Proloque, in The Evolutionary Synthesis at 1, 36 (E. Mayr & W. Provine eds. 1980) ("macroevolution, which deals with evolutionary phenomena above the species level"); Stanley*, Macroevolution and the Fossil Record 36 Evolution 460, 471 (1982); G. Simpson*, The Major Features of Evolution 338 (1953).

196. Dobzhansky*, Evolution, 10 Encyclopedia Americana 734, 748 (1982). Accord, A. Thompson*, Biology, Zoology, and Genetics 1 (1983); see G. Hardin*, Nature and Man's Fate 66 (1959)("'From amoeba to man' became a catchword after Darwin."); G. Stebbins*, Darwin to DNA, Molecules to Humanity 174 (1982) ("Part Two: The Course of Evolution: from Molecules to Primates).

197. E.g., S. Stanley*, Macroevolution: Pattern and Process (1979); Gould*, Irrelevance, Submission and Partnership: The Changing Role of Paleontology in Darwin's Three Centennials and a Modest Proposal for Macroevolution, in Evolution from

not at issue in this case, because all creationist scientists agree that it has occurred and does occur,198/ although they

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Molecules to Men 347, _____(D. Bendall ed. 1983); Ayala*, Microevolution and Macroevolution in Evolution from Molecules to Men 387, _____ (D. Bendall ed. 1983); Gould* & Eldredge*, Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered, 3 Paleobiology 115, 139, passim (1977); G. Stebbins* & F. Ayala*, Is a New Evolutionary Synthesis Necessary?, 213 Science 967, 968, 971 (1981); Gould*, G. G. Simpson, Paleontology, and the Modern Synthesis, in The Evolutionary Synthesis 153, 170 (E. Mayr & W. Provine eds. 1980); D. Raup* & S. Stanley*, Principles of Paleontology 303 (ed. 1978); Raup*, The Geological and Paleontological Arguments of Creation, in Scientists Confront Creation 147, 162 (L. Godfrey ed. 1983).

198. E.g., Kenyon, The Creationist View of Biologic Origins NEXA Journal, Spring 1984, at 28, 31-34:

> It is of course possible that new species, genera, and occasionally even families, may have arisen by natural means since the original creation, provided that the new forms did not contain significantly more genetic information than their progenitors. Examples here might include Darwin's

generally prefer to use another term for microevolution.198a/

Macroevolution. The noncompelling status of biological macroevolution, and

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finches (some of which are known to interbreed in the wild leaving fertile offspring) (Bowman 1982), and the thousands of species of orchids.

The field studies reported in the evolutionary journals involve microevolutionary change, about which there is no dispute. In any case, even though we may . . .. It is worth mentioning again that besides the origin of life, the major disagreement between creationists and evolutionists involves macroevolution, not microevolution. Both sides are in substantial agreement about the latter. In fact creationists regard much of what Darwin wrote to be basically correct. Moreover, they acknowledge the validity of most of the research described in the journals of evolutionary biology. Outside the subject of [macro] evolution there is substantial agreement between the two sides on at least 90% of the subject matter of the biological sciences.

Id. at 28.

198a. Grassé* emphasized: "To vary and to evolve are two different things; this can never be sufficiently emphasized . . .." P. Grassé*, The Evolution of Living Organisms _____(trans. 1977).

the comparable scientific nature of it and biological creation, are material facts at issue in this case. The Defendants do not seek to disprove macroevolution, but instead seek to show that it is not compellingly established, so that rational scientists may disagree and hold other scientific viewpoints. This is a material factual issue.

Rejection of macroevolution and skepticism toward it is widespread among noncreationist scientists as well as among creationist scientists. In fact, "scientists who utterly reject evolution may be one of our fastest-growing controversial minorities."199/ There are "some among the biologists who feel that much of the fabric of [macroevolutionary] theory accepted by the majority today is actually false," and "a

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199. Hatfield*, Educators Against Darwin, Science Digest Special, Winter 1979, at 94, 94.

generally silent group of students engaged in biological pursuits who tend to disagree with much of the current thought."200/ Transformed cladists generally "question much of conventional evolutionary history" and are "at odds with evolutionary thinking," as described further below.201/ Grassé*, "the most distinguished of French zoologists,"202/ has concluded that "the explanatory doctrines of biological evolution do not stand up to an objective in depth criticism."203/ Macroevolution has similarly

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200. Olson*, Morphology, Paleontology, and Evolution, 1 Evolution after Darwin 523, 523 (S. Tax ed. 1960).

201. Patterson*, Cladistics & Classification, _____ New Scientist 303, 306 (1982); Beatty*, Classes and Cladistics, 31 Systematic Zoology 25, 31 (1982); § 2[A](2)(a)(v) infra.

202. Dobzhansky*, Book Review, 29 Evolution 379, 376 (1975).

203. P. Grassé*, Evolution of Living Organisms 202 (trans. 1977); Dobzhansky* summarizes Grassé's position and credentials:

The book of Pierre P. Grassé is a

been rejected or severely criticized by such other noncreationist scientists as Kerkut*, Vernet*, Sermonti* and Fondi*, and Lemoine*,204/ as well as such recent

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frontal attack on all kinds of "Darwinism." Its purpose is "to destroy the myth of evolution as a simple, understood, and explained phenomenon," and to show that evolution is a mystery about which little is, and perhaps can be, known. Now, one can disagree with Grassé but not ignore him. He is the most distinguished of French zoologists, the editor of the 28 volumes of "Traité de Zoologie", author of numerous original investigations, and ex-president of the Academie des Sciences. His knowledge of the living world is encyclopedic, and his book is replete with interesting facts that any biologist would profit by knowing. Unfortunately, the theoretical interpretations of these facts leaves one dissatisfied, and occasionally exasperated.

Dobzhansky*, Book Review, 29 Evolution 376, 376 (1975).

204. E.g., G. Kerkut*, Implications of Evolution 157 passim (1961); Address of Dr. Colin Patterson*, American Museum of Natural History, tr. at 4 (Nov. 5, 1981) ("The second theme is that evolution not only conveys no knowledge but seems somehow to convey antiknowledge . . . ."); M. Vernet, Révolution en Biologie (1969); G.

noncreationists as Hitching*, Taylor*, Macbeth*, Rifkin*, and Himmelfarb*.205/ Koestler* concludes that the macroevolutionary "citadel they are defending lies in ruins"; Rifkin* calls it "little more than an imaginary trip"; and Bethell sees "Darwin's theory . . . on the verge of collapse."206/ Among high school teachers,

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Sermonti & R. Fondi, Dopo Darwin: Critica all' Evoluzionismo (1980); 5 Encyclopedie Francaise 82-83 (P. Lemoine ed. 197__)("The theories of evolution with which our studious youth have been deceived, constitute a dogma that all the world continues to teach, but each in his specialty, the zoologist or the botanist, ascertain that none of the explanations furnished are adequate.")

205. E.g., F. Hitching*, The Neck of the Giraffe: Where Darwin Went Wrong (1982); G. Taylor*, The Great Evolution Mystery 137-38 (1983) (the theory of evolution by natural selection seems either inadequate, implausible or definitely wrong.) ; N. Macbeth*, Darwin Retried (1971); J. Rifkin*, Algeny 135 (1983)("Darwin and his twentieth-century apologists have been in error."); G. Himmelfarb*, Darwin and the Darwinian Revolution (1959).

206. A. Koestler*, Janus: A Summing Up 192 (1978); J. Rifkin*, Algeny 125 (1983); Bethell*, Darwin's Mistake, Harper's Magazine, Feb. 1976, at 70, 72.

"a significant minority of them simply do not believe a word of it."207/

Not Fact. The statement is often made that "evolution is a fact."208/ Although microevolution is indeed a fact (concurred in by creationist scientists), macroevolution is not a fact but only a "partly demonstrated theory," in the words of leading evolutionists Dobzhansky*, Ayala*, Stebbins*, and Valentine*:

> evolution at the subspecific level by means of recognized processes is now regarded by most biologists as an experimentally demonstrated fact. On the other hand, some doubt the ability of these processes, by themselves, to give rise to genera, families, or any groups of organisms having "new" characteristics. "Transspecific evolution" [macroevolution] is generally recognized as a reality, but its explanation on the basis of recognized processes is still in the stage of partly demonstrated theory or, in the case of the origin and early differentiation of

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207. G. Simpson*, This View of Life 30 (1964).

208. _____.

the first cellular organisms, a working hypothesis.209/

As only a "partly demonstrated theory," macroevolution is not so compellingly established that it is beyond scientific challenge or alternate scientific explanations. Along that line, White*, in his presidential address to the prestigious Linnaean Society, said that "I have often thought how little I should like to prove organic evolution in a court of law."209a/

Overview. The following Subsections discuss the following aspects of biological macroevolution:

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209. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 5 (1977). "Transspecific evolution" in the quotation means macroevolution. D. Raup* & S. Stanley*, Principles of Paleontology 103 (2d ed. 1978).

209a. McClelland*, Letter, Chemical & Engineering News, Sept. 21, 1981, at 5.

(a) Approaches to macroevolution,
(b) Mechanism of macroevolution,
(c) Evidence for macroevolution, and
(d) Stages of macroevolution.

Subsection (a) discusses current approaches to macroevolution: classical Darwinian evolution, the Neo-Darwinian synthesis, punctuated equilibria, non-Darwinian approaches, transformed cladistics, and other anti-evolutionist approaches. Subsection (b) discusses the alleged mechanism of macroevolution, which involves the "three main processes--mutation, genetic recombination, and natural selection"210/--in conjunction with other factors. Subsection (c) discusses the the alleged evidence for macroevolution: the paleontology argument, the phylogenies

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210. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 5 (1977). Accord, D. Raup* & S. Stanley*, Principles of Paleontology 103 (2d ed. 1978).

argument, the classification argument, the comparative anatomy argument, the comparative embryology argument, the comparative biochemistry argument, the population genetics argument, and the artificial selection argument. Finally, Subsection (d) discusses the alleged stages of macroevolution: from prokaryotes to eukaryotes, to plants and to invertebrates, to vertebrate fish, to amphibians, to reptiles, to birds and to lower mammals, to primates, and finally to man. All citations in these Subsections are to noncreationists, including the citations that acknowledge severe problems with biological macroevolution. The noncompelling status of macroevolution, and the comparably scientific nature of biological creation and biological macroevolution, are material factual issues.

(a) Approaches to Macroevolution. There are at least six significant approaches

to macroevolution. These are (i) classical Darwinian evolution, which has been effectively abandoned; (ii) the Neo-Darwinian synthesis, which is the majority viewpoint; (iii) punctuated equilibria, the growing minority viewpoint; (iv) non-Darwinian approaches; (v) the transformed cladist approach, also a growing approach with many proponents rejecting macroevolution entirely; and (vi) the antievolutionist approaches (other than creation-science).

(i) "Classical Darwinian evolution" is the viewpoint advocated by Darwin in The Origin of Species. Modern evolutionist scientists, while generally not forthrightly announcing that it is dead, have stated that classical Darwinism is wrong in its gradualism and its explanation of the lack of fossil intermediate forms,211/ in Dar-

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211. Gould* acknowledges:
The extreme rarity of transitional

win's prediction that fossil discoveries would fill the gaps,212/ in his pangenesis

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> forms in the fossil record persists as the trade secret of paleontology. The evolutionary trees that adorn our textbooks have data only at the tips and nodes of their branches; the rest is inference, however reasonable, not the evidence of fossils. Yet Darwin was so wedded to gradualism that he wagered his entire theory on a denial of this literal record; . . ..
>
> The geological record is extremely imperfect and this fact will to a large extent explain why we do not find interminable varieties, connecting together all the extinct and existing forms of life by the finest graduated steps. He who rejects these views on the nature of the geological record, will rightly reject my whole theory.

Gould*, Evolution's Erratic Pace, Natural History, May 1977, at 13, 14. He also states:

> To Darwin . . . speciation entailed the same expectation as phyletic evolution: a long and insensibly graded chain of intermediate forms. Our present texts have not abandoned this view, although modern biology has.

Eldredge* & Gould*, Punctuated Equilibria: An Alternative to Phyletic Gradualism, in Models in Paleobiology ____, 89 (W. Schopf ed. 1972).

212. Eldredge* and Tattersall* concede: He prophesied that future generations of paleontologists would fill in these

and gemmules approach to heredity,213/ and in classical Darwinism's view of natural selection as differential mortality.214/ An

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gaps by diligent search and then his major thesis--that evolutionary change is gradual and progressive--would be vindicated. One hundred and twenty years of paleontological research later, it has become abundantly clear that the fossil record will not confirm this part of Darwin's predictions. Nor is the problem a miserably poor record. The fossil record simply shows that this prediction was wrong.

N. Eldredge* & I. Tattersall*, The Myths of Human Evolution 45-46 (1982).

213. Stansfield* points out this error:

> One of the most damaging omissions to a complete theory of evolution was the lack of knowledge at that time of the mechanism of heredity and the origin of variations through genetic mutation. To fill this void, Darwin proposed a "pangenesis theory," according to which all parts of the body generate minute particles called "gemmules," which were carried by the blood . . ..

W. Stansfield*, The Science of Evolution 38 (1977). Accord*, Dobzhansky*, Evolution 10 Encyclopedia Americana 734, 738 (1982).

214. Rosen* notes that macroevolutionists have "redefined natural selection":

> That their concern was justified is indicated by the retreat of selection-

interesting book by a noncreationist carefully establishes that "classical Darwinism is no longer considered valid by qualified biologists" and is "sadly decayed" in all its parts.215/

(ii) The "neo-Darwinian synthesis," often called the "modern evolutionary syn-

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> ists to a seemingly fortified position which rejected Darwin's original concept as a creative force in the origin of new species and redefined natural selection in terms of population genetics.

Rosen*, Book Review, 27 Systematic Zoology 370, 370 (1978). See also Dobzhansky*, Evolution 10 Encyclopedia Americana 734, 743 (1982).

215. Macbeth* concludes:

> I assert only that the mechanism of evolution suggested by Charles Darwin has been found inadequate by the professionals, and that they have moved on to other views and problems. In brief, classical Darwinism is no longer considered valid by qualified biologists.
>
> . . . .
>
> In examining the single parts of classical Darwinism, I conclude that they were all sadly decayed.

N. Macbeth*, Darwin Retried 6, 134 (1971).

thesis" or "phyletic gradualism," is defined by Ernst Mayr*, a leading proponent, as involving

> two conclusions: gradual evolution can be explained in terms of small genetic changes ('mutations') and recombination, and the ordering of this genetic variation by natural selection; and . . . macroevolutionary processes and speciation, can be explained in a manner that is consistent with the known genetic mechanisms.216/

An essential part of the neo-Darwinian synthesis is gradualism,217/ and another essential part is "the overwhelming importance of natural selection."218/ This neo-Darwin-

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216. Mayr*, Prologue, in The Evolutionary Synthesis 1, 1 (E. Mayr* & W. Provine* eds. 1980). Accord, Mayr*, Evolution, Scientific American, Sept. 1978, at 47, 52; D. Raup* & S. Stanley*, Principles of Paleontology 327 (2d ed. 1978); S. Luria*, S. Gould* & S. Singer*, A View of Life 765 (1981); T. Dobshansky*, Genetics and the Origin of Species 7-8 (2d ed. 1941).

217. E.g., T. Dobshansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 166 (1977) ("The evolution was gradual; sudden radical transformations did not occur.")

218. Mayr*, Evolution, Scientific American., Sept. 1978, at 47, 52. Accord,

ian synthesis has been described as "effectively dead, despite its persistence as textbook orthodoxy," and as "breaking down," by Gould* (an ACLU witness).219/ Its "obituary" has been written according to Platnick*, and it is "dead" in the view of Macbeth*.220/ The gradualism of macroevolutionary change, which most neo-Darwinists insist on, has been severely attacked

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T. Dobshansky*, F. Ayala*, G . Stebbins* & J. Valentine*, Evolution 504 (1977).

219. Gould*, Is a New and General Theory of Evolution Emerging?, 6 Paleobiology 120-21 (1980). He states in full:

> I have been reluctant to admit it . . . but if Mayr's characterization of the synthetic theory is accurate, then that theory, as a general proposition, is effectively dead, despite its persistence as textbook orthodoxy.
>
> . . . .
>
> The synthesis is now breaking down on both sides of this argument. Many evolutionists now doubt exclusive control by [natural] selection upon genetic change within local populations.

Id. at 120, 121.

220. Macbeth*, How to Defuse a Feud, Kronos, Summer 1982, at 1, 3-4.

as "a myth" (Eldredge* and Tattersall*), as "untenable in light of fossil evidence" (Stanley*), as having "broken down on both its fundamental claims" and as having "no support" in the "fossil record" (Gould*), and as known to be wrong by paleontologists "privately . . . for over a hundred years" (Eldredge*).221/ The overwhemling import-

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221. N. Eldredge* & I. Tattersall*, The Myths of Human Evolution 2 (1982); S. Stanley*, Macroevolution 11 (1979); Gould*, Darwinism and the Expansion of Evolutionary Theory, 216 Science 380, 382 (1982); Gould*, The Return of Hopeful Monsters, Natural History, June-July 1977, at 22, 22; Eldredge*, in Did Darwin Get It Wrong? 6 (Transcript from NOVA No. 816, WGBH, Boston, Mass. Nov. 1. 1981). Eldredge* states in full:

> It is, indeed, a very curious state of affairs, I think, that paleontologists have been insisting that their record is consistent with slow, steady, gradual evolution where I think that privately, they've known for over a hundred years that such is not the case. I view stasis and the trumpeting of stasis to the whole world that the fossil record shows slow, steady, continuous change (as opposed to herky jerky patterns of change) as something akin to the "Emperor's new clothes." Paleonto-

ance of natural selection" has also been savagely attacked as wrong, and the extrapolation of microevolution to explain macroevolution (Mayr's* second point) has been similarly ravaged, as discussed below.222/

(iii) The "punctuated equilibria" ap-

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logists have known this for over a hundred years.

Id. Gould* elaborates on abrupt appearances and systematic gaps:

> The fossil record offered no support for gradual change: whole fauna had been wiped out during disarmingly short intervals (see my column of October 1974). New species almost always appeared suddenly in the fossil record with no intermediate links to ancestors in older rocks of the same region.

Gould*, Evolution's Erratic Pace, Natural History, May 1977, at 12, 12. Stanley* says that there is not "a single example" of gradual change:

> The known fossil record fails to document a single example of phyletic [gradual] evolution accomplishing a major morphologic transition and hence offers no evidence that the gradualistic model can be valid.

S. Stanley*, Macroevolution: Pattern and Process 39 (1979).

222. Sections 2[a](2)(b) and 2[a](2)(b)(i) infra.

proach is the "idea that considerably more than 50 percent of evolution occurs through the proliferation of species."223/ It explains macroevolution by "very rapid events of speciation" (species appearance), "the differential success of certain species" in relation to other species, and nonchange

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223. Raup* and Stanley* contrast punctuated equilibria with the neo-Darwinian synthesis:

> The idea that considerably more than 50 percent of evolution occurs through the proliferation of species has been termed the punctuated equilibrium model of evolution or the punctuational model. The name refers to the step-like or "punctuated" nature of the phylogenetic model. . . . The opposing idea, that considerably more than 50 percent of evolution occurs as phyletic change within established species, has been termed phyletic gradualism or the gradualistic model [or Neo-Darwinism].

D. Raup* & S. Stanley*, Principles of Paleontology 326-27 (2d ed. 1978). Accord, G. Stebbins*, Darwin to DNA, Molecules to Humanity 475 (1982); Gould*, The Ediacaran Experiment, Natural History, Feb. 1984, at 14, 23.

(stasis) of "most species," so that "most species . . . either do not change in any appreciable way, or else they fluctuate mildly in morphology, with no apparent direction."224/ Punctuated equilibria acknowledges the existence of most of the abrupt appearances of complex organisms in the fossil record, of most of the systematic gaps between fossil types, (the "trade secret of paleontology"), and of most of the stasis that biological creation identifies (although punctuated equilibria interprets these phenomena very differently).225/ The

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224. Gould* & Eldredge*, Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered, 3 Paleobiology 115, 115 (1977). Accord, S. Luria*, S. Gould* & S. Singer*, A View of Life 625 (1981).

225. E.g., Gould*, Evolution's Erratic Pace, Natural History, May 1977, at as, 12 ("New species almost always appeared suddenly in the fossil record with no intermediate links to ancestors in older rocks of the same region."); P. Grassé*, The Evolution of Living Organisns 84 (trans. 1977) ("present living beings dif-

punctuated equilibria approach views this nongradual fossil record and other factors as fatal to the modern evolutionary synthesis.226/ One significant problem with punctuated equilibria is that macroevolution allegedly occurs only where no fossils are left (in small populations), and that macroevolution should also occur elsewhere as well and should leave fossils (in intermediate populations at an intermediate rate)227/

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fer [hardly] at all from those of the past."); Section 2[a](1)(a) & (b) supra.

226. Note 221 supra.

227. Stanley* recognizes this problem:

> We might conclude that if large populations, like those in A and B, evolve slowly, and if small populations sometimes evolve rapidly, then populations of intermediate size may, on the average, evolve at intermediate rates. This is presumably the case; yet I will offer evidence that few major transitions occur (few higher taxa originate) except in quite small populations.

S. Stanley*, Macroevolution 28 (1979). Studies of speciation do "not support Eldredge and Gould's claim that speciating populations are small," and give reason to question "whether evolution is rapid in

Another problem is the lack of persuasive evidence for species selection and the same difficulties for it as for natural selection.

(iv) "Non-Darwinian" approaches to macroevolution are taken by "a generally silent group of students engaged in biological pursuits who tend to disagree with much of the current thought,"228/ and by many leading scientists such as zoologist Grassé* of France ("the most distinguished of French zoologists"), Nobel laureate Szent-Gyorgyi*, the late geneticist Goldschmidt* of Berkeley, and the late geneticist De Vries*. Grassé* concludes:

> Their success among certain biologists, philosophers, and sociologists notwithstanding, the explanatory doctrines of biological evolution do not stand up to an objective, in-depth criticism. They prove to be either in conflict

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small populations." Ridley*, _____, 286 Nature, 444, _____ (1980).

228. Olson*, Morphology, Paleontology, and Evolution, 1 Evolution after Darwin 523, 523 (S. Tax ed. 1960).

with reality or else incapable of solving the major problems involved.229/ Szent-Gyorgyi* rejects the neo-Darwinian approach and casts aside "the usual answer . . . that there was plenty of time to try everything."230/ The saltationists, such

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229. P. Grassé*, Evolution of Living Organisms 202 (trans. 1977). He is described by Dobzhansky* as "the editor of the 28 volumes of "Traité de Zoologie", author of numerous original investigations, and ex-president of the Academie of Sciences. His knowledge of the living world is encyclopedic." Dobzhansky*, Book Review, 29 Evolution 376, 376 (1975). Grassé* also states:

> Present-day ultra-Darwinism, which is so sure of itself, impresses incompletely informed biologists, misleads them, and inspires fallacious interpretations. . . .
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> . . ..
>
> Through use and abuse of hidden postulates, of bold, often ill-founded extrapolations, a pseudoscience has been created. It is taking root in the very heart of biology and is leading astray many biochemists and biologists, who sincerely believe that the accuracy of fundamental concepts has been demonstrated, which is not the case.

P. Grassé*, The Evolution of Living Organisms ____, ____ (trans. 1977).

230. Szent-Gyorgyi*, The Evolution-

as famed geneticists De Vries* and Goldschmidt*, paleontologists Schindewolf* and Spath*, and neontologist Clark* rejected Darwinism and proposed a "hopeful monster" approach or macromutations, and some modern saltationists follow suit, such as Grant* and Wolsky*.231/ Many non-Darwinians find no explanation satisfactory for macroevolution, such as Lemoine*, Løvtrup*, Macbeth*,

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ary Paradox and Biological Stability, in Molecular Evolution: Prebiological and Biological, 111 (D. Rohlfing & A. Oparin eds. 1972) ("I could never accept this answer. Random shuttling of bricks will never build a castle or a Greek temple, however long the available time.").

231. R. Goldschmidt*, The Material Basis of Evolution (1940); O. Schindewolf*, Grundfragen der Paleontologie (1950); L. Spath*, The Evolution of the Cephalopoda, 8 Biol. Rev. 418 (1933); A. Clark*, The New Evolution: Zoogenesis (1930); see G. Simpson*, The Major Features of Evolution 360 (1953); Mayr*, Evolution, Scientific American, Sept. 1978, at 47, 49; V. Grant*, Organismic Evolution (1977); M. Wolsky* & A. Wolsky*, The Mechanism of Evolution: A New Look at Old Ideas (1976).

Ambrose*, Russell*, and Martin*.232/ Some other non-Darwinians fall back on "a population genetics view," such as Lewontin*, Kimora*, Crow*, Ohta*, Thoday*, and

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232. Encyclopedie Francaise 82-83 (P. Lemoine* ed. 197__)("The theories of evolution with which our studious youth have been deceived, constitute a dogma that all the world continues to teach, but each in his specialty, the zoologist or the botanist ascertain that none of the explanations furnished are adequate. . . . It results from this summary that the theory of evolution is impossible."); Løvtrup*, Letter 24 Systematic Zoology 507, 507 (1975) ("I think you will appreciate why I find Mr. Norman Macbeth is justified in the criticisms he advances in his extremely readable book and in his letter to you. And that by option for Goldschmidt's theory he demonstrates a deeper understanding of the realties of phylogenetic evolution than most members of the 'fraternity'."); N. Macbeth*, Darwin Retried 134 (1971) ("In examining the single parts of classical Darwinism, I concluded that they were all sadly decayed."); E. Ambrose*, The Nature and Origin of the Biological World 131 (1982); E. Russell*, The Diversity of Animals 69-71 (1962) ("Also the profusion and variety of form and behavior is such as to render extremely improbable the theory that these forms have arisen through the natural selection of chance variations which happened to be advantageous in the struggle

and Ewens*.233/ Some popular writers have launched attacks on Darwinism and all explanations of macroevolution, such as Hitching*, Taylor* ("inadequate, implausible, or definitely wrong"), Himmelfarb*, Rifkin*, and Koestler.*234/ These are all noncreationists who reject Darwinian

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for existence. . . . These facts, so well illustrated in the Decapods, must lead us to doubt the general validity of the utilitarian theory of evolution."); Martin*, A Non-Geneticist Looks at Evolution, 41 American Scientist 100, 100, 105 (1953)("Nevertheless there are some like myself who cannot see that the mutation-selection theory is wholly convincing as a means of explaining natural evolution and, perhaps erroneously, we believe that our dissent is not so much due to a failure to master the facts as to our grasp of some facts which we think geneticists are apt to overlook. . . . The object of this paper is to show that this theory may be an illusion.").

233. G. Wassermann*, Testability of the Role of Natural Selection within Theories of Population Genetics and Evolution, 29 British J. of Philosophy of Science 223, 234 (1978).

234. E.g., F. Hitching*, The Neck of the Giraffe: Where Darwin Went Wrong (1982); G. Taylor*, The Great Evolution Mystery 137-38 (1983) (the theory of evolution by na-

macroevolution of both major schools (neo-Darwinian synthesis and punctuated equilibria).

(v) The "transformed cladist" approach is one of the three major schools of classifying organisms,235/ and is "neutral or opposed to evolutionary theorizing of any kind in systematics," operating instead "in a non-evolutionary domain."236/ The

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tural selection seems either inadequate, implausible or definitely wrong.); J. Rifkin*, Algeny 135 (1983) ("Darwin and his twentieth-century apologists have been in error."); G. Himmelfarb*, Darwin and the Darwinian Revolution ___ (1959); A. Koestler*, Janus: A Summing Up 185 (1978).

235. Cladistics is a "philosophy of classification that arranges organisms only by their order of branching in an evolutionary tree and not by their morphological similarity." S. Luria*, S. Gould* & S. Singer*, A View of Life 763 (1981). Accord, Platnick*, Philosophy and the Transformation of Cladists, 28 Systematic Zoology 537, 538 (1979).

236. Ball*, On Groups, Existence and the Ordering of Nature, 32 Systematic Zoology 446, 446 (1983). Accord, Beatty*, Classes and Cladists, 31 Systematic Zoology 25, 29 (1982) ("Apparently in response to

word "transformed" refers to a "transformation away from dependence on evolutionary theory."237/ For example, Patterson*, a paleontologist at the British Museum, to-

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the perceived crisis in evolutionary biology, cladists have taken more or less extreme measures to sever their ties to that discipline."); Beatty*, id. at 31 ("But pattern cladistics is not, after all, evolutionarily neutral. It is at odds with evolutionary thinking."); Patterson*, Cladistics and Classification, ____ New Scientist 303, 306 (1982) ("Thus cladistics calls into question much of conventional evolutionary history.").

237. Patterson*, Cladistics. 27 Biologist 234, _____(1980) ("But as the theory of cladistics had developed, it has been realized that more and more of the evolutionary framework is inessential', and may be dropped. . . . Platnick refers to the new theory as transformed cladistics' and the transformation is away from dependence on evolutionary theory. Indeed, Gareth Nelson, who is chiefly responsible for the transformation, put it like this in a letter to me this summer: 'In a way, I think we are merely rediscovering preevolutionary systematics; or if not rediscovering it, fleshing it out.'"); Forey*, Neontological Analysis Versus Palaeontological Stories, in Problems of Phylogenetic Reconstruction 119, 119, 124 (K. Joysey & A. Friday eds. 1982).

tally rejects macroevolution:

> It's true that for the last eighteen months or so I've been kicking around non-evolutionary or even anti-evolutionary ideas. . . .
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> . . ..
>
> So that is my first theme. That evolution and creation seem to be sharing remarkable parallels that are increasingly hard to tell apart. The second theme is that evolution not only conveys no knowledge but it seems somehow to convey anti-knowledge.238/

(vi) The "antievolutionist" approach is taken by many noncreationist scientists. Olson* reports that there are "some among the biologists who feel that much of the [macroevolutionary] theory accepted by the majority today is actually false."239/ Kerkut*, a leading biochemist who is at the

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238. Address of Dr. Colin Patterson* at American Museum of Natural History, tr. at 1, 4 (Nov. 5, 1981).

University of Southhampton, systematically assesses the evidence for macroevolution and finds it weak:

> What conclusions, then, can one come to concerning the validity of the various implications of the theory of evolution? If we go back to our initial assumptions it will be seen that the evidence is still lacking for most of them.240/

Lipson*, a British physicist, rejects macroevolution based on his scientific analysis of it:

> I have always been slightly suspicious of the theory of evolution because of its ability to account for any property of living beings (the long neck of the giraffe, for example). I have therefore tried to see whether biological discoveries over the last thirty years or so fit in with Darwin's theory. I do not think that they do.
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> . . . .
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> To my mind, the theory does not stand up at all.241/

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239. Olson*, Morphology, Paleontology, and Evolution, 1 Evolution after Darwin 523, 523 (S. Tax ed. 1960).

240. G. Kerkut*, Implications of Evolution 150 (1960).

241. Lipson*, A Physicist Looks at Evolution, 31 Physics Bulletin 138, 138 (1980).

Sermonti*, the Director of the Institute of Genetics at University of Palermo, and Fondi* reject macroevolution because of its scientific weakness,242/ and Vernet* in France reaches a similar conclusion.243/ Philosopher Rifkin* similarly finds microevolution wanting.244/

Summary. Thus, of six scientific ap-

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242. G. Sermonti* & R. Fondi*, Dopo Darwin: Critica all' Evoluzionismo (1980). Sermonti* read one of twelve papers at the Pontifical Academy of Sciences in 1982, taking a scientific position contrary to macroevolution.

243. M. Vernet*, Revolution en Biologie (1969); M. Vernet*, La Grande Illusion de Teilhard de Chardin (1964); M. Vernet*, L Evolution du Monde Vivant (1950).

244. J. Rifkin*, Algeny 135 (1983) ("The fossil record and modern breeding techniques both argue convincingly that Darwin and his twentieth-century apologists have been in error. Both the fossils and experiments in breeding overwhelmingly attest to the fact that variations within a species promote stasis, not transformation; yet the extrapolation continues, despite all the concrete evidence to the contrary."). Accord, A. Standen*, Science Is a Sacred Cow (1950).

proaches to macroevolution other than creation-science, classical Darwinism has been abandoned, three approaches are anti-Darwinian, and two oppose biological macroevolution. These latter two schools provide strong reasons for concluding that biological macroevolution is not compellingly established and has serious problems.

(b) Alleged Mechanism for Macroevolution. Macroevolution may legitimately be regarded as noncompelling as long as no plausible mechanism is offered to show that it can occur.

Factors. The three primary factors in a mechanism for macroevolution are described as (i) natural selection, (ii) mutation, and (iii) genetic recombination, as described by leading evolutionists Dobzhansky*, Ayala* (an ACLU witness), Stebbins*, and Valentine*:

> three main processes--mutation, genetic recombination, and natural selection

. . . .

> In a nutshell, the [neo-Darwinian synthesis] theory maintains that mutation and sexual recombination furnish the raw materials; that natural selection fashions from these materials' genotypes and gene pools; and that, in sexually reproducing forms, the arrays of adaptively coherent genotypes are protected from disintegration by reproductive isolating mechanisms.247/

Other factors frequently mentioned are (iv) migration and (v) genetic drift.248/ Advo-

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247. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 5, 129 (1977). Mayr* similarly states:

> The first step is the production (through recombination, mutation, and chance events) of genetic variability; the second is the ordering of that variability by selection. Most of the variation produced by the first step is random in that it is not caused by, and is unrelated to, the current needs of the organism or the nature of its environment.

Mayr*, Evolution, Scientific American, Sept. 1978, at 47, 52. Accord, Mayr*, Prologue in The Evolutionary Synthesis 1, 1 (E. Mayr & W. Provine eds. 1980); G. Stebbins*, Darwin to DNA, Molecules to Humanity 24-25 (1982); Dobzhansky*, Evolution, 10 Encyclopedia Americana 734, 741 (1982); F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 110 (1979).

248. E.g., Smith*, The Limitations of

cates of punctuated equilibria agree that the preceding factors exist, but hold that these factors only produce microevolution ("phyletic evolution").249/ They list sev-

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Evolutionary Theory, in 2 The Encyclopedia of Ignorance 235, 235-42 (R. Duncan & M. Weston-Smith eds. 1977); T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 72, 157 (1977); S. Luria*, S. Gould* & S. Singer*, A View of Life 769 (1981); D. Raup* & S. Stanley*, Principles of Paleontology 106 (2d ed. 1978); Alexander*, Evolution, Creation, and Biology Teaching, in Evolution versus Creationism at 90, 95-96 (P. Zetterberg ed. 1983); Saunders* & Ho*, Is Neo-Darwinism Falsifiable?--And Does It Matter?, 4 Nature and System 179, 180 (1982).

249. E.g., D. Raup* & S. Stanley*, Principles of Paleontology 103 (2d ed. 1978) ("Phyletic evolution usually results from the operation of natural selection on the genetic composition of one or more populations. Variation in the gene pool produces variation in the phenotype (form, structure, physiology, and behavior) of organisms making up the population. This variability arises in various ways. The most fundamental way is by point mutations, which represent changes in single genes . . . [M]ost of the total variability within populations arises as the changed genetic material is recombined or reshuffled among all the members of the population in the process of reproduction."); S. Luria*, S. Gould* & S. Singer*, A View of Life 625 (1981)("genes mutate, individuals are selected, and species evolve.").

eral other factors, which they view as the mechanisms of macroevolution: (vi) species selection, (vii) speciation and extinction, and (viii) other factors.250/ Each school of macroevolution (neo-Darwinian and punctuational) offers a set of factors as almost totally explaining the mechanism of macroevolution that the other school regards as virtually insignificant.251/ 150

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250. E.g., Stanley*, Macroevolution and the Fossil Record, 36 Evolution 460, 471 (1982); Gould*, The Promise of Paleobiology as a Nomothetic, Evolutionary Discipline, 6 Paleobiology 96, 106 (1980); S. Luria*, S. Gould* & S. Singer*, A View of Life 618-19, 626 (1981).

251. E.g., T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 5 (1977) ("Few biologists now doubt that these three processes, acting concurrently, can be responsible for the origin of diverse races and species."); F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 110 (1979) ("Thus, evolution may be seen as a two-step process . . . mutation and recombination" and natural selection.); Stanley*, Macroevolution and the Fossil Record, 36 Evolution 460, 471 (1982) ("phyletic evolution" "amounts to little more than fine tuning",

leading macroevolutionists of both schools met in Chicago in 1980 to discuss the mechism of macroevolution, and came away without any agreement on any viable mechanism to explain how macroevolution could occur.252/ The following paragraphs show that natural selection and all of these other factors fail to provide or help provide a workable mechanism for macroevolution.

Extrapolation. The choice of mechanism depends on the question whether microevolutionary change can be assumed ultimately to produce macroevolutionary change ("extrapolation" from microevolution to macroevolution), and this is a critical point of

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while "speciation events are largely responsible for the origin of higher taxa."); Gould*, The Promise of Paleobiology as a Nomothetic, Evolutionary Discipline, 96, 106 (1980) ("Macroevolutionary changes are a result of the differential success of species," or species selection.).

252. Lewin*, Evolutionary Theory Under Fire, 210 Science 883 (1980).

disagreement. Neo-Darwinians answer yes, and identify microevolution (factors (i)-(iii)) as the mechanism for macroevolution.253/ Punctuated equilibria advocates answer no, attacking the "fallacy of direct extrapolation,"254/ and identify different factors

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253. E.g., T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 6 (1977) ("Subspecific evolution and transspecific evolution are not different phenomena or processes: they are two aspects of the same series of processes and phenomena. They extrapolate to the transspecific level by comparing individuals or populations that have evolved over time spans measured in terms of millions of generations or years. Findings at the subspecific level can be applied to the transspecific level if one grants that the processes that promote evolutionary change in modern populations have been active throughout the millions of years during which organisms have existed. Extrapolation from the present to the past is therefore possible. Like all estrapolation, however, it can succeed only if it is based upon enough information of the right kind."); Mayr*, Prologue, in The Evolutionary Synthesis 1, 1 (E. Mayr & W. Provine eds. 1980).

254. Gould* & Eldredge*, Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered, 3 Paleobiology 115, 143 (1977). Accord, Gould*, The Return of Hopeful Monsters, Natural History, June 1977, at 22,

(factors (vi)-(viii)) as the mechanism for macroevolution. Creationist scientists also answer no, and point to the insufficiency of any of these factors for producing macroevolution. Two philosophers address this extrapolation question and find "no evidence" for extrapolation:

> The real question, however, and this is what the claim to sufficiency is all about, is whether all of evolution can be explained as an extrapola-

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_____ ; Gould*, The Promise of Paleobiology as a Nomothetic, Evolutionary Discipline, 8 Paleobiology 96, 106 (1980) ("this process cannot be smoothly extrapolated to encompass evoluionary trends, because macroevolution resides on another level of the evolutionary hierarchy"). Eldredge* and Tattersall* write:

> What is wrong with the synthesis is not the core neoDarwinian formulations of mechanics (natural selection working on variation within species to effect gradual change). What is wrong is the wholesale, uncritical--and unwarranted --extrapolation of these mechanisms via metaphors such as the adaptive landscape to embrace the evolution and diversification of all life.

N. Eldredge* & I. Tattersall*, The Myths of Human Evolution 44 (1982).

tion from these examples, i.e., as arising from the natural selection of many small random variations. Is evolution nothing more than industrial melanism writ large? On this--the crucial issue--there is no evidence in favor of the synthetic theory. From the claims that are made for neo-Darwinism one could easily get the impression that it has made great progress towards explaining evolution, leaving mostly details to be cleared up. In fact, quite the reverse is true. Neo-Darwinism can account for some of the details, but the major problems remain unsolved. Samuel Butler's (1911) complaint that Darwin had given us "an Origin of the Species with the 'Origin' cut out" is as true today as when he wrote it.255/

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255. Saunders* & Ho, Is Neo-Darwinism Falsifiable?--And Does it Matter?, 4 Nature and System 179, 191 (1982). Gould* similarly states:

> Geneticists can study the gradual increase of favored genes within populations of fruit flies in laboratory bottles. Naturalists can record the steady replacement of light moths by dark moths as industrial soot blackens the trees of Britain. Orthodox neo-Darwinians extrapolate these even and continuous changes to the most profound structural transitions in the history of life: by a long series of insensibly graded intermediate steps, birds are linked to reptiles, fish with jaws to their jawless ancestors. Macroevolution (major structural transition) is no-

The Chicago conference in 1980 addressed extrapolation as its central question, and the answer was "a clear No."256/ Many nonpunctuationists also reject extrapolation and denounce "the faith . . . that macroevolution can be accounted for in principle by the same factors that bring about microevolution."257/

> thing more than microevolution (flies in bottles) extended. If black moths can displace white ones in a century, then reptiles can become birds in a few million years by the smooth and sequential summation of countless changes. Change of gene frequencies in local populations is an adequate model for all evolutionary processes--or so the current orthodoxy states.

Gould*, The Return of Hopeful Monsters, Natural History, June 1977, at 22, ___.

256. Lewin*, Evolutionary Theory Under Fire, 210 Science 883, 883 (1980). Although there was no consensus on whether macroevolution is totally decoupled from microevolution, many scientists argue that "macroevolution is decoupled from microevolution." Stanley*, A Theory of Evolution Above the Species Level, 72 Proceedings of National Academy of Science 646, 648 (1975).

257. E. Russell*, The Diversity of Animals, 123 (1962). Accord, G. Kerkut*,

(i) Natural Selection and Problems.

Natural selection258/ is "the fundamental

Implications of Evolution 157 (1961) ("It is not clear whether the changes that bring about speciation are of the same nature as those that brought about the development of new phyla."); P. Grassé*, The Evolution of Living Organisms 87-88 (trans. 1976) ("How does the Darwinian mutational interpretation of evolution account for the fact that the species that have been the most stable--some of them for the last hundreds of millions of years--have mutated as much as the others do? . . . Once one has noticed microvariations (on the one hand) and specific stability (on the other), it seems very difficult to conclude that the former (microvariation) comes into play in the evolutionary process."); G. Simpson*, The Major Features of Evolution 338 (1953) ("Goldschmidt uses his terms to emphasize the belief that microevolution, so defined, is something definitely and qualitatively different from macroevolution and not involved in or leading to the latter."); W. Grant*, Organismic Evolution ____ (1977); Kitts*, Paleontology and Evolutionary Theory, 20 Evolution 458-472 (1974); Ricklefs*, Book Review, 199 Science 58-60 (1978); M. Wolsky* & A. Wolsky*, The Mechanism of Evolution: A New Look at Old Ideas ___ (1976); N. Macbeth*, Darwin Retried 34, 35 (1971) ("there is no evidence that micro changes cumulate into macro effects"); see Stebbins* & Ayala*, Is a New Evolutionary Synthesis Necessary?, 213 Science 967, 967 (1981) ("Thus, macroevolution and microevolution

process directing evolutionary change" and "the main process responsible for the adaptations of organisms," according to gradualists Dobzhansky*, Ayala*, Stebbins*, and Valentine*.259/ However, many noncreationist biologists and philosophers of science attack natural selection as being insufficient to act as a factor in macroevolution:

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are decoupled in the important sense that macroevolutionary patterns cannot be deduced from microevolutionary principles.").

258. "Natural selection" is the "central process of Darwinism, whereby organisms best adapted to local environments leave more surviving offspring and spread their favored traits through populations." S. Luria*, S. Gould* & S. Singer*, A View of Life 775 (1981). Accord, F. Ayala* & J. Valentine*, Evolving: The Theory & Processes of Organic Evolution 440 (1979).

259. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 32, 504 (1977). Accord, Mayr*, Prologue, in The Evolutionary Synthesis 1, 24 (E. Mayr & W. Provine eds. 1980) ("second of the two principal components of Darwin's theory of evolution").

> In spite of the reverence that many systematists hold for neo-Darwinian evolution and natural selection, some biologists (Løvtrup, 1974; Rosen and Buth, 1980) doubt its merits, and philosophers have questioned the value of the theory of natural selection (Barker, 1969; Brady, 1979; Grene, 1974; Smart, 1963).260/

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260. Maze*, Neo-Darwinian Evolution--Panacea or Popgun, 31 Systematic Zoology 92, 93 (1982). Accord, Forey*, Neontological Analysis Versus Palaeontological Stories, in Problems of Phylogenetic Reconstruction 119, 124 (K. Joysey & A. Friday eds. 1982) ("Suffice it to say that there have been recent views (Løvtrup 1977; Macbeth 1973; Rosen 1978) expressing serious doubts about the theory of natural selection, or at least the ways in which it may be tested and placed on a scientific plane. I confess sympathy with these views."); Gruner*, On Evolution and Its Relation to Natural Selection, 16 Dialogue 708, 714 (1977)("The belief is now prevalent that evolution and natural selection are connected in that the former--alone or together with other factors--explains why the latter occurs. In fact, however, in the situation of today the belief is lacking in support."); Rosen*, Book Review, 27 Systematic Zoology 370, 373 (1978) (hoping that "'natural selection' is stripped from our technical vocabulary and irrelevant argument ceases in consequence"); F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 40 (1983) ("Unless it is arbitrarily assumed that these characteristics had some great but

For example, Stanley* writes that "natural selection, long viewed as the process guiding evolutionary change, cannot play a significant role in determining the overall course of evolution."261/

The problem with natural selection that many philosophers of science have attacked is that it does not provide an ade-

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unknown different use during their development, it must be concluded that Darwinian natural selection played little or no part in their origin."); G. Simpson*, The Major Features of Evolution 118-19 (1953) ("it might be argued that the theory is quite unsubstantiated and has status only as a speculation."); N. Macbeth*, Darwin Retried 45-46 (1971).

261. Stanley*, A Theory of Evolution Above the Species Level, 72 Proc. National Academy of Science 646, 648, 650 (1975). Accord, Gould*, Is a New and General Theory of Evolution Emerging?, 6 Paleobiology 119-130 (1980) ("Many evolutionists now doubt exclusive control by [natural] selection upon genetic change within local populations."); Wiley* & Broks*, Victims of History--A Nonequilibrium Approach to Evolution, 31 Systematic Zoology 1 (1982) (rejecting natural selection as a significant factor in speciation).

guate mechanism to bring about macroevolution ultimately from one or more first living cells to all existing life, even if it may bring about microevolution. Instead, natural selection has been attacked by several dozen philosophers in published articles as being unfalsifiable and untestable262/ or tautologous263/ or all three. For example, Brady* finds natural selection unfalsifiable and thus not a sufficient mechanism or part of a mechanism at all:

> [M]ost recent critics have already understood this and are actually arguing that the theory is not falsifiable in its operational form. Under examination, the operational forms of the concepts of adaptation and fitness turn out to be too indeterminate to be seriously tested, for they are protected by ad hoc additions drawn from an indeterminate realm.264/

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262. These are listed and quoted in Section 2[e](2)(b) and 2[e](3)(b) infra.

263. These are listed and quoted in Section 2[e](1)(a)(ii) infra.

264. Brady*, Natural Selection and the Criteria by Which a Theory is Judged, 28 Systematic Zoology 600, 600 (1979).

Similarly, Waddington* of University of Edinburgh concludes that natural selection is a tautology:

> Natural selection . . . turns out on closer inspection to be a tautology, a statement of an inevitable although previously unrecognized relation. It states that the fittest individuals in a population (defined as those which leave the most offspring) will leave most offspring.265/

In response to these and other criticisms, natural selection has been drastically redefined, yet not openly but by subterfuge:

> If the theory of natural selection, as formulated by Darwin is tautological, and if the neoDarwinists have retreated from the criticism of this tautology by redefining natural selection in more esoteric terms (= population genetics or ecological genetics)--even though it still does not explain either the appearance of evolutionary novelties or evolutionary diversity--then biologists might appear to an onlooker to have rejected modern synthetic evolutionary theory but practiced a subterfuge to retain it as the orthodox

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265. Waddington*, Evolutionary Adaptation, in 1 Evolution After Darwin 381, 385 (S. Tax ed. 1960).

position.266/

Another problem with natural selection that biologists have attacked is that it is not supported by any persuasive examples relevant to macroevolution, even though a few examples involve microevolution. Grassé* and others argue:

> The role assigned to natural selection in establishing adaptation, while speciously probable, is based on not one single sure datum. Paleontology (cf. the case of the transformation of the mandibular skeletion of the theriodont reptiles) does not support it; direct observation here and now of the genesis of a hereditary adaptation is nonexistent, except , as we have stated, in the case of bacteria and insects preadapted to resist viruses or drugs.267/

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266. Rosen*, Book Review, 27 Systematic Zoology 370, 372 (1978).

267. Grassé*, Evolution of Living Organisms 170 (trans. 1977). Cracraft* similarly limits natural selection:

> Moreover, it is clear that statements about natural selection should be restricted to the intrapopulational level of analysis; extending natural selection to specific and supraspecific levels, as do nearly all of the above

The "most famous, strongly documented case" is that of "the replacement of light-colored by dark-colored moths in industrial areas of England after trees were coated with soot," so that birds picked off the more visible light-colored moths and caused the

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cited studies, further confuses the issue of process analysis (Eldredge and Cracraft, 1980).

Cracraft*, The Use of Functional and Adaptive Criteria in Phylogenetic Systematics, 21 Am. Zoologist 21, 34-35 (1981). Philosopher Grene* states that "minute specialized adaptations" are not relevant to macroevolution or even the origin of species:

> And if one returns to the Origin [of Species] with these criticisms in mind, one finds, indeed, that for all the brillance of its hypotheses piled on hypotheses, for all the splendid simplicity of the "mechanism" by which it "explains" so many and so varied phenomena, it simply is not about the origin of species, let alone of the great orders and classes and phyla, at all. Its argument moves in a different direction altogether, in the direction of minute specialised adaptations, which lead, unless to extinction, nowhere. . . . How from single-celled (and for that matter from inanimate) ancestors there came to be castor beans and moths and snails, and how from

dark-colored moths to become more prevalent. 268/ Grassé* and others note that this is not macroevolution but only "insignificant" microevolution:

> At best, present evolutionary phenomena are simply slight changes of genotypes within populations, or substitution of an allele by a new one. For example, the mutant carbonaria of the birch moth, Biston betularia, replaces the regular butterfly in polluted industrial areas (Haldane, 1956; Ford, 1971). . . . Some biologists maintain that they cannot only observe it but also describe it in action; the facts that they describe, however, either have nothing to do with evolution or are insignificant.269/

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these there emerged llamas and hedgehogs and lions and apes--and men--that is a question which neo-Darwinian theory simply leaves unasked.
Grene*, The Faith of Darwinism, Encounter, Nov. 1959, at 48, 49.

268. S. Luria*, S. Gould* & S. Singer*, A View of Life 626 (1981). Kettlewell* calls it "the most striking evolutionary change ever witnessed by man." Kettlewill*, Darwin's Missing Evidence, Scientific American, Mar. 1959, at 48, ___.

269. P. Grassé*, Evolution of Living Organisms 84 (trans. 1977). Philosophers Saunders* and Ho* similarly describe these as "minor evolutionary changes":

The same is true of Darwin's example of

> Neo-Darwinist textbooks on evolution keep citing the same comparatively few examples: industrial melanism, sickle cell anaemia, DDT resistance. All are comparatively minor evolutionary changes; all involve variations in which a large and obvious selective advantage can be obtained by a single allele substitution.

Saunders* & Ho*, Is Neo-Darwinism Falsifiable?--And Does It Matter?, 4 Nature and System 179, 191 (1982). Accord, Brady*, Dogma and Doubt, 17 Biological J. of the British Linnaean Soc. 79, 89, 90 (1982) ("There are two parts to this proposal. The first is that selective pressure can approximate the breeder; the second, which I have termed 'central', is that the differential so produced can culminate in new forms. The industrial melanism observations have confirmed prediction with regard to the first part, i.e., a specific change in allele frequency, parallel to that produced by a breeder, may be caused by onesided predator pressure (one-sided in that the melanistic variant is better camouflaged). Can this confirmation be transferred to part two?

Not at all, since this is the more radical claim. There seems to be some confusion about this point, but the argument is simple enough. What if such differentials do not culminate in new forms? After all, they did not do so in experiments mentioned."); Mathews*, Introduction to C. Darwin, The Origin of Species xi (1971) ("they do not show evolution in progress, for however the populations may alter in

Galapagos finches.270/ Another frequent example is breeding experiments, which similarly show nothing about macroevolution, but instead are human-directed and do not generate new species (or higher categories of organisms), as discussed below.271/

Other problems with natural selection that biologists have attacked are that overall natural selection and mutation would lead to downward evolution rather than upward evolution,272/ that it is inconsistent

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their content of light, intermediate or dark forms, all the moths remain from beginning to end Biston betularia.").

270. Grene*, The Faith of Darwinism, Encounter, Nov. 1959, at 48, 49 ("There are, indeed, all the minute specialised divergences like those of the Galapagos finches which so fascinated Darwin; it is their story that is told in the Origin and elaborated by the selectionists to-day. But these are dead ends, last minutiae of development; it is not from them that the great massive noveltie s of evolution could have sprung.").

271. Section 2[a](2)(c)(viii) infra.

272. Hoyle states:

The situation as it turns out mathematically is a tussle between the eradica-

with the mass extinctions of the past, 273/ and that it is inconsistent with the vast

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> tive effect of natural selection on the one hand and the frequency with which small damaging mutations arise on the other, with many small mutations adding up to produce serious disadaptation to the environment. Nor does it turn out that natural selection always adds up the much rarer cases in which mutations happen to be good. Indeed for good mutations that are small the adding up process which should spread the mutations is exceedingly weak. Natural selection works, in short, only when the variations on which it operates are large, and quite likely it is this situation which supporters of the Darwinian theory have constantly at the back of their minds.
>
> The Darwinian theory is wrong because random variations tend to worsen performance, as indeed common sense suggests they must do.

F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 41, 48 (1983).

273. Raup*, Conflicts between Darwin and Paleontology, Field Museum of Natural History Bull., Jan. 1979, at 22, 29; N. Macbeth*, Darwin Retried 118 (1971) ("The best clincher is extinction.

For every species now in existence, roughly ninety-nine have become extinct. The question of why they have become extinct is of enormous importance to evolutionists. It has been studied by many men,

variety in nature that is neutral rather than adaptive or beneficial.274/ For these

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but a convincing answer has not been found. It remains unclear why any given species has disappeared.

The discussion of survival of the fittest showed that the phrase led to circular reasoning; you survive because you are fit and you are fit because you survive. Discussion of extinction is beset by a similar danger. It is all to easy to say that a species becomes extinct because it fails to adapt, while establishing its failure to adapt only by its becoming extinct: in other words, you die because you are unfit and you are unfit because you die."). This also includes the question why some species have not become extinct. G. Simpson*, The Meaning of Evolution 202 (rev. ed. 1967); N. Macbeth*, Darwin Retried 120-21 (1971).

274. Darwin stated:

> I did not formerly consider sufficiently the existence of structures which, as far as we can . . . judge, are neither beneficial nor injurious, and this I believe to be one of the greatest oversights as yet detected in my work. This led to my tacit assumption that every detail of structure was of some special though unrecognized service.

L. Eisley*, The Unexpected Universe 142 (1969). Accord, E. Russell*, The Diversity of Animals 69-71 (1962) ("Also the profusion and variety of form and behaviour is such as to render extremely improbable the theory that these forms have arisen through

various reasons, many scientists deny that natural selection is a significant factor in macroevolution.

(ii) Mutations and Problems.

Mutation275/ is also one of the "three main

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the natural selection of chance variations which happended to be advantageous in the struggle for existence.

. . ..

The following questions suggest themselves. Why are there so many variants on the same typal theme, so many family and generic sub-types, most of which do not show any marked adaptive specialisation, so far at least as our limited knowledge goes? Why is there such a profusion of strange and fantastic forms, especially in the deep sea? Why do so many genera split up into a multiplicity of species, whose differences, so far as we can see, are not "adaptive"? To these questions the utilitarian theory gives no satisfactory answer.

These facts, so well illustrated in the Decapods, must lead us to doubt the general validity of the utilitarian theory of evolution.")

275. "Mutation" is "a change in the genetic material" (or DNA). S. Luria*, S. Gould* & S. Singer*, A View of Life 775 (1981); F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 440 (1979). "They can be classified in one of two major categories: gene

processes" of "organic evolution," and "the mutation process is the ultimate source of this variability," according to Dobzhansky*, Ayala*, Stebbins*, and Valentine*.276/ Mutations "are the only raw material of evolution," according to both neo-Darwinists and punctuationists.277/

(or point) mutations, which affect only one or a few nucleotides within a gene; and chromosomal mutations (or aberrations), which affect the number of chromosomes, or the number or the arrangement of genes in a chromosome." T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 57 (1977). Accord, Stebbins* & Ayala*, Is a New Evolutionary Synthesis Necessary?, 213 Science 967, 967 (1981).

276. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 5, 107 (1977). Accord, Mayr*, Evolution, Scientific Am., Sept. 1978, at 47, 52.

277. Mayr*, Prologue, in The Evolutionary Synthesis 1, 20 (E. Mayr & W. Provine eds. 1980). Accord, S. Luria*, S. Gould* & S. Singer*, A View of Life 625 (1981) ("Mutations are the ultimate source of new genetic variability."); Stebbins* & Ayala*, Is a New Evolutionary Synthesis Necessary?, 213 Science 967, 967 (1981) ("mutations are the ultimate source of the genetic variation that makes possible the evolutionary process."); F. Ayala* & J.

While there is no question that mutations occur, one problem is the insignificant scope of nonfatal mutations, which Grassé* and many others argue prevents any contribution to macroevolution:

> merely hereditary fluctuations around a medium position; a swing to the right, a swing to the left, but no final evolutionary effect . . . they modify what pre-exists. . . . No matter how numerous they may be, mutations do not produce any kind of evolution.278/

Valentine*, Evolving: The Theory and Processes of Organic Evolution 110 (1979) ("Mutations are the ultimate source of all hereditary variability.").

278. P. Grassé*, The Evolution of Living Organisms _____, 88 (trans. 1977). Accord, Gould* & Eldredge*, Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered, 3 Paleobiology 115, 151 (1977) ("We do not see how point mutations in structural genes can lead, even by gradual accumulation, to new morphological designs."); Stanley*, Macroevolution and the Fossil Record, 36 Evolution 460, 471 (1982) ("the apparently trivial role of mutation pressure"); E. Ambrose*, The Nature and Origin of the Biological World 122 (1982) ("minor changes due to point mutations have little effect on the overall integrated activities."); E. Russell*, The Diversity of

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Animals 123 (1962) ("It would seem on the face of it that genemutations provide a very unpromising raw material for large scale evolution. Viable mutations are of the same order as the trivial differences between intra-specific races, and as such seem quite incapable of giving rise to the major divergences of structuro-functional organization which characterise large scale habit and habitat specialisation and typal diversification."); Martin*, A Non-Geneticist Looks at Evolution, 41 American Scientist 100, 104 (1953) ("too trifling and insignificant to be credited with even the most microscopic survival value.")

Some scientists question whether any mutations at all are beneficial.279/ Another problem is the tiny frequency of nonharmful mutations. The difficulty is that "point mutations occur on average only once in each complete copying of the whole 200,000 chains" of DNA,280/ and of these "the fre-

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279. Martin*, A Non-Geneticist Looks at Evolution, 41 American Scientist 100, 100, 102, 103 (1953)("all mutations seem to be in the nature of injuries that, to some extent, impair the fertility and viability of the affected organisms. I doubt if among the many thousands of known mutant types one can be found which is superior to the wild type in its normal environment, only very few can be named which are superior to the wild type in a strange environment. . . . all, or almost all, known mutations are unmistakably pathological and the few remaining ones are highly suspect."). Darwin himself stated:

> When we descend to details, we can prove that no species has changed (i.e., we cannot prove that a single species has changed); nor can we prove that the supposed changes are beneficial, which is the groundwork of the theory.

F. Darwin, 2 The Life and Letters of Charles Darwin _____ (1888).

280. F. Hoyle, The Intelligent Universe 35 (1983).

quency with which a single non-harmful mutation is known to occur is about 1 in 1000."281/ Then several mutations are necessary to affect almost any significant trait.282/

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281. E. Ambrose*, The Nature and Origin of the Biological World 120-21 (1982). Accord, Huxley*, Evolution in Action 45 (1953).

282. E. Ambrose*, The Nature and Origin of the Biological World 123-24 (1982) ("The difficulties in explaining the origin of increased complexity as a result of bringing a 'cluster' of genes together within the nuclei of a single organism in terms of probabilities, fade into insignificance when we recognize that there must be a close integration of functions between the individual genes of the cluster, which must also be integrated into the development of the entire organism. The improbability increases at an enormous rate as the number of genes increases from one to five. . . . The problem of bringing together the five mutated genes we are considering, within a single nucleus, and for them to 'fit' immediately into this vast complex of interacting units, is indeed difficult. When it is remembered that they must give some selective advantage, or else become scattered once more within the population at large, due to interbreeding, it seems impossible to explain these events in terms of random mutation alone."). Wald estimates that

These problems leave it improbable that mutations (even if natural selection were effective) could be a factor in significant macroevolution.

(iii) Genetic Recombination and Problems. Genetic recombination, along with natural selection and mutation, is also one of the "three main processes" of organic evolution.283/ It involves the combination of genes of both parents in an offspring through sexual reproduction.284/ As the phrase im-

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"something of the order of 10 million years is needed to establish a mutation. That is, each of these single amino acid changes appears relatively frequently in individuals as pathology; but to establish one such change as a regular characteristic in a species seems to take something of the order of 10 million years." Wald*, Discussion, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution _____ (P. Moorehead & M. Kaplan, eds. 1967).

283. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 5 (1977). Accord, Mayr*, Prologue, in The Evolutionary Synthesis, 1, 1 (E. Mayr & W. Provine eds. 1980).

284. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 129

plies, recombination only rearranges the "raw material" for natural selection, and does not generate the new genes required for macroevolution.

(iv) Migration and Problems. Migration is defined as "gene flow . . . from one to another population."285/ It can "help maintain high levels of genetic variation in natural populations.286/ However, like recombination, it only rearranges existing genes, and does not generate any new genes necessary for macroevolution.

(1977); S. Luria*, S. Gould* & S. Singer*, A View of Life 780 (1981).

285. F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 115 (1979); Smith*, The Limitations of Evolutionary Theory, in 2 The Encyclopedia of Ignorance 235, 235-42 (R. Duncan & M. Weston-Smith eds. 1977).

286. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 72 (1977). Accord, Smith*, The Limitations of Evolutionary Theory, in 2 The Encyclopedia of Ignorance 235, 235-42 (R. Duncan & M. Weston-Smith eds. 1977).

(v) Genetic Drift and Problems. Genetic drift has been defined as "directional change in gene frequency that arises by chance but that persists without being favored by natural selection."287/ This "random drift can diversify an array of genetically identical but isolated populations . . . without intervention of natural selection," but only in the sense of changing the relative frequency of particular genes that already are present in the various populations.288/ Again, although gene frequencies

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287. D. Raup* & S. Stanley*, Principles of Paleontology 106 (2d ed. 1978). Accord, F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 438 (1979).

288. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 157 (1977). Accord, E. Dodson, Evolution: Process and Product 258-59 (1960) ("Genetic drift is a force working in opposition to selection, for it tends to preserve or destroy genes without distinction, whether favorable, neutral or unfavorable."); S. Luria*, S. Gould* & S. Singer*, A View of Life 769 (1981).

within a population certainly can shift, this only explains changes of the proportion of a population with preexisting genes and does not generate the new genes necessary to macroevolution.

(vi) Species Selection and Problems. While advocates of the neo-Darwinian synthesis generally believe that the preceding five factors are a sufficient mechanism for macroevolution, advocates of punctuated equilibria generally believe that those five factors are insufficient . Punctuationists instead point to speciation, species selection, and other factors as the only sufficient mechanisms for macroevolution:

> How, then, do large-scale evolutionary trends (macroevolutionary trends) develop? . . . There are three ways in which such change is accomplished. 1. By phyletic evolution--. . . this mode of change amonts to little more than fine tuning. 2. By speciation--by the addition of new species. I have concluded that speciation events are largely responsible for the origin of higher taxa. 3. By

> extinction--by the loss of species from the higher taxa. Extinction obviously cannot produce a new higher taxon, but it does automatically modify the properties of existing higher taxa. . . . Species selection. This is a change in the composition of a segment of phylogeny resulting from some combination of differential rates of speciation and differential rates of extinction among species.291/

Species selection is "analogous to natural selection but acts upon species within higher taxa rather than upon individuals in populations."292/ It is the predominant factor in macroevolution to punctuationists: "species selection . . . must largely determine the overall course of evolution" according to Stanley*, and the cause of "macroevolu-

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291. Stanley*, Macroevolution and the Fossil Record, 36 Evolution 460, 471 (1982). Accord, Gould*, The Promise of Paleobiology as a Nomothetic, Evolutionary Discipline, 6 Paleobiology 96, 106 (1980). Stanley* continues with a discussion of "phylogenetic drift," "directed speciation," and "species selection."

292. Stanley*, A Theory of Evolution Above the Species Level, 72 Proc. National Academy of Science 646, 646 (1975).

tionary changes" according to Gould*.293/

Although not much has been published by opponents yet, species selection is criticized by neo-Darwinians as simply not a significant mechanism for macroevolution, and will doubtless be attacked as sharing the same general weaknesses that natural selection has. Many philosophers of science will probably criticize species selection as unfalsifiable and circular, and many biologists will probably criticize it as not supported by any persuasive evidence other than the insufficiency of natural selection.

(vii) Speciation and Extinction and Problems. "Speciation" occurs "when a small subpopulation branches off from its parent-

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293. Stanley*, A Theory of Evolution Above the Species Level, 72 Proc. National Academy of Science 646, 646, 648 (1975); Gould*, The Promise of Paleobiology as a Nomothetic, Evolutionary Discipline, 6 Paleobiology 96, 106 (1980).

al population and diverges to become a new species."294/ It is "the more important process and . . . the key to understanding larger patterns in evolution," according to punctuationists.295/ Species appear through speciation and disappear through extinction.296/

While the microevolutionary development of new species and the extinction of old ones is not questioned, neo-Darwinian scientists and creationist scientists both question whether speciation is part of a sufficient mechanism for macroevolution. One problem is that scientists "have absolutely no idea what happens genetically during

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294. S. Luria*, S. Gould* & S. Singer*, A View of Life 626, 639 (1981).

295. Id. at 618-19. Accord, Stanley*, Macroevolution and the Fossil Record, 36 Evolution 460, 471 (1982).

296. Gould*, The Ediacaran Experiment, Natural History, Feb. 1984, at 14, 23; S. Luria*, S. Gould* & S. Singer*, A View of Life 618-19 (1981).

speciation"; this was the conclusion of "an international conference in Rome in 1981 on the mechanisms of speciation . . . attended by many of the leading botanists, zoologists, paleontologists, geneticists, cytologists, and biologists."297/ A further and related problem is that no persuasive evidence ties speciation to macroevolution. Even if speciation sometimes occurs rapidly in small populations without leaving fossil traces, as punctuated equilibria hypothesizes, it should occur at intermediate rates in intermediate populations and should leave some fossil evidence if it progressed to macroevolutionary steps.297a/

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297. Interview: Ernst Mayr, Omni, Feb. 1983, at 73, 78. Bush* states that "our models of speciation must remain little more than speculation based on the subjective interpretation of equivocal data." Bush*, What Do We Really Known about Speciation?, in Perspectives on Evolution at 119, 119 (R. Milkman ed. 1982).

297a. Stanley* recognizes this problem:

That fossil evidence does not exist, and some studies show that speciating populations are not generally small and that speciation does not occur more rapidly in small populations.297b/ Of course. "extinction obviously cannot produce a new higher taxon" (or new genes), but can only eliminate existing ones.298/

(viii) Other Factors and Problems.

We might conclude that if large populations, like those in A and B, evolve slowly, and if small populations sometimes evolve rapidly, then populations of intermediate size may, on the average, evolve at intermediate rates. This is presumably the case; yet I will offer evidence that few major transitions occur (few higher taxa originate) except in quite small populations.

S. Stanley*, Macroevolution 28 (1979). Studies of speciation do "not support Eldredge and Gould's claim that speciating populations are small," and give reason to question "whether evolution is rapid in small populations." Ridley, _____, 286 Nature, 444, _____(1980).

297b. Ridley*, _____, 286 Nature 444, ___ (1980).

298. Stanley*, Macroevolution and the Fossil Record, 36 Evolution 460, 471 (1982).

Some evolutionist scientists point to other factors as all or part of the mechanism of macroevolution, such as adaptation, regulatory genes, selfish genes, paedomorphosis, and saltation. These factors are insufficient to produce macroevolution.

"Adaptation," or a feature that assists an organism for life in its environment, is called "almost tautological" by Sir Karl Popper* because it is another way of saying "selected" by natural selection.299/ "Regu-

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299. Popper*, Autobiography of Karl Popper, in 1 The Philosophy of Karl Popper 1, 137 (P. Schilpp ed. 1974) ("To say that a species now living is adapted to its environment is, in fact, almost tautological. Indeed, we use the terms 'adaptation' and 'selection' in such a way that we can say that, if a species were not adapted it would have been eliminated by natural selection. Similarly, if a species has been eliminated it must have been ill adapted to the conditions."). Accord, Brady*, Natural Selection and the Criteria by Which a Theory is Judged, 28 Systematic Zoology 600, 608 (1979).

If we substitute "adaptive complexity" for "fitness" we are indeed in danger

latory genes," which allegedly "switch on and off batteries of protein-producing genes," are an area where "speculation is free, for we know nothing about these regu-

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of tautology, since the term "adaptive," by presuming some sort of positive adaptation to fit the environment, already means "fit," and thus it has no explanatory value here.

Thus, no one can accurately identify "adaptive" traits unless an organism dies (and thus was nonadaptive). G. Stebbins*, Variation and Evolution in Plants 118 (1950) ("Unfortunately, however, the determination of the adaptive character of many types of differences between organisms is one of the most difficult problems in biology."); G. Simpson*, The Major Features of Evolution 278 (1953) ("The fallibility of personal judgments as to the adaptive value of particular characters, most especially when these occur in animals quite unlike any now living, is notorious."); Dobzhansky*, Book Review, 29 Evolution 376 (1975) ("not even a biologist of Grassé's experience can judge reliably which 'characters' are neutral, useful, or harmful in a given species."); Leith*, Are the Reports of Darwin's Death Exaggerated?, 166 The Listener 390, 392 (1981) (Patterson*: "I think there is a valid criticism that has been made by a number of people that Darwinists . . . sometimes come up with very fanciful adaptive explanations of things. . . . [S]ometimes they're completely fanciful and false.").

latory master genes, and that they exist is only an informed guess."300/ "Selfish genes," which are postulated as a "self-replicating molecular assembly" with a selective advantage, is "tautologous" and only hypothetical.301/ "Paedomorphosis," or "changes in the developmental rates of features already present,"302/ is related to the regulatory gene suggestion and is not persuasively supported. "Saltation," or evolution by vast "systematic mutations,"

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300. C. Patterson*, Evolution 143 (1978).

301. E. Ambrose*, The Nature and Origin of the Biological World 124 (1982)("The 'selfish gene' is defined as a self-replicating molecular assembly which in any given situation has a selective advantage over other self-replicating systems. It will therefore survive. No argument about such a definition is possible. It is of the type criticised by Popper [as tautologous]. The emergence of all living organisms and of surviving populations is then explained in terms of the 'selfish gene.'").

302. S. Luria*, S. Gould* & S. Singer*, A View of Life 636 (1981). Accord, Gould*, The Return of Hopeful Monsters, Natural History, June 1977, at 22, ____.

is based on postulated mutations that "have never appeared."303/

Summary. Thus, macroevolution lacks any persuasive mechanism (although there is no question that microevolution has occurred and is occurring). In fact, each major school of evolutionists denies the sufficiency of the mechanism proposed by the other school for macroevolution. Without a credible mechanism, macroevolution is not compellingly established, particularly in view of the weakness of the alleged evidence that macroevolution has occurred. This is a

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303. P. Grassé*, Evolution of Living Organisms 31 (trans. 1977). Accord, Stebbins* & Ayala*, Is a New _____, 213 Science 967, 969 (1981) ("The specific solution postulated by Goldschmidt, that is, the occurrence of systematic mutations, yielding hopeful monsters, can be excluded in view of current genetic knowledge."); Wright*, Character Change, Speciation, and the Higher Taxa, 36 Evolution ____, 440 (1982); Lande*, Microevolution in Relation to Macroevolution, in Evolution Now 146, 146 (J. Smith ed. 1982).

material factual issue.

(c) Alleged Evidence for Macroevolution. The major arguments for macroevolution are described by Stansfield* as follows:

> Two of the major lines of evidence supporting the evolutionary theory, namely paleontology and biogeography, were presented in the last chapter. This chapter presents further supporting evidence drawn from the disciplines of taxonomy, comparative embryology, comparative anatomy, comparative biochemistry, and physiology.308/

The following paragraphs describe (i) the paleontology argument, (ii) the phylogenies argument, (iii) classification (taxonomy) argument, (iv) the comparative anatomy argument, (v) the comparative embryology argument, (vi) the comparative biochemistry argument, (vii) the population genetics

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308. W. Stansfield*, The Science of Evolution 98 (1977). See also Committee on Science and Creationism*, Science and Creationism: A View from the National Academy of Sciences 15 (1984).

argument, and (viii) the artificial selection argument. These alleged evidences for macroevolution appear very weak in the eyes of Grassé* ("the greatest of French zoologists"), Kerkut* (editor of a major biochemistry Journal), and other noncreationist scientists , as well as creationist scientists:

> Through use and abuse of hidden postulates, of bold, often illfounded exrapolations, a pseudoscience has been created. It is taking root in the very heart of biology and is leading astray many biochemists and biologists, who sincerely believe that the accuracy of fundamental concepts has been demonstrated, which is not the case.309/

(i) Paleontology Argument and Problems.

The paleontology argument310/ for macroevo-

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309. P. Grassé*, The Evolution of Living Organisms 6 (trans. 1977). Accord, G. Kerkut*, Implications of Evolution vii (1960) ("The attempt to explain all living forms in terms of an evolution from a unique source, though a brave and valid attempt, is one that is premature and not satisfactorily supported by present-day evidence.").

310. "Paleontology" is "the study of fossils," which are "the remains or traces

lution is based on the fossil record. "Direct study of macroevolutionary patterns is only possible in the fossil record,"311/ and this fossil record "forms our most direct evidence . . . of the course of biological evolution."312/ Yet the fossil record is characterized by systematic abrupt appearances of groups of organisms and systematic gaps between groups, rather than by generally progressive emergence of one group from another (as discussed above313/). Consequently, even though the fossil record is the "most direct evidence" of macroevo-

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of former life." W. Stansfield*, The Science of Evolution 67 (1977).

311. Valentine*, Darwin's Impact on Paleontology, 32 BioScience 513, 517 (1982). Accord, P. Grassé*, The Evolution of Living Organisms 4 (trans. 1977) ("only paleontology can provide . . . the evidence of evolution and reveal its course or mechanism.")

312. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 314 (1977).

313. Section 2[a](1)(a) supra.

lution, Ridley* states that "no real evolutionist, whether gradualist or punctuationist, uses the fossil record as evidence in favour of the theory of evolution as opposed to special creation."314/

The overwhelming problem that the fossil record poses for macroevolution is that it is characterized by abrupt appearances

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314. Ridley*, Who Doubts Evolution? New Scientist 830 (1981). Patterson*, a paleontologist with the British Museum concludes:

> I conclude that instances of fossils overturning theories of relationship based on Recent organisms are very rare, and may be nonexistent. It follows that the widespread belief that fossils are the only or best means of determining evolutionary relationships is a myth. Tracing how this myth came to be an article of faith among biologists [an "Idol of the Academy" (70)] should be an interesting study in the sociology of science; it seems to have followed, as an unquestioned corollary, from acceptance of evolution.

Patterson*, Significance of Fossils in Determining Evolutionary Relationships, 12 Ann. Rev. of Ecology and Systematics 195, 218 (1981).

and systematic gaps, as paleontologist Gould* of Harvard acknowledges:

> Increasing diversity and multiple transitions seem to reflect a determined and inexorable progression toward higher things. But the paleontological record supports no such interpretation. There has been no steady progress in the higher development of organic design. We have had, instead, vast stretches of little or no change and one evolutionary burst that created the entire system.
>
> New species almost always appeared suddenly in the fossil record with no intermediate links to ancestors in older rocks of the same region.315/

The systematic gaps are actually "the trade secret of paleontology":

> The extreme rarity of transitional forms in the fossil record persists as the trade secret of paleontology. The evolutionary trees that adorn our textbooks have data only at the tips and nodes of their branches; the rest is inference, however reasonable, not the

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315. Gould*, The Five Kingdoms, Natural History, June-July 1976, at 30, 37; Gould*, Evolution's Erratic Pace, Natural History, May 1977, at 12, 12. Accord, Section 2[a](1)(a) supra.

evidence of fossils.316/

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316. Gould*, Evolution's Erratic Pace, Natural History, May 1977, at 13, 14. Accord, P. Grassé*, The Evolution of Living Organisms 31 (trans. 1977)("from the almost total absence of fossil evidence relative to the origin of the phyla, it follows that any explanation of the mechanism in the creative evolution of the fundamental structural plans is heavily burdened with hypotheses. . . . The lack of direct evidence leads to the formulation of pure conjectures as to the genesis of the phyla; we do not even have a basis to deteremine the extent to which these opinions are correct."); A. Boyden*, Perspectives in Zoology 27 (1973) ("It is understandable, then, that since the beginnings of our fossil records, there appear to have been no major types evolved from other major types, such evolution, if it did occur, having taken place before the fixation of the original major phyletic types."); George*, _____, 48 Science Progress 1 (1960) ("Granted an evolutionary origin of the main groups of animals, and not on an act of special creation, the absence of any record whatsoever of a single member of any of the phyla in the Precambrian rocks remains as inexplicable on orthodox grounds as it was to Darwin."); G. Simpson*, The Major Features of Evolution 360 (1953) ("most new species, genera and families, and that nearly all categories above the level of families, appear in the record suddenly and are not led up to by known, gradual, completely continuous transitional sequenc-

The alleged evolutionary trees are not just mostly "inference" rather than "data," but are "highly conjectural" and either do not support or actually "deny" macroevolution.317/ The alleged transitional forms

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es."); A. Boyden*, Perspectives in Zoology 35 (1973) ("The evidences relating to the Age of Stabilization do lend themselves to interpretation on the Neo-Darwinian basis, all this evolution being subspeciational and completely graded in origin, and the gaps between species having been secondarily acquired."); Section 2[a](1)(a)(ii) supra.

317. Hoyle and Wickramasinghe state:

> These diagrams include many divergencies which have not been proved by the fossil record, so if they occurred the transitions must again have been rapid. The diagrams are therefore highly conjectural. It has been through the device of presenting such diagrams with the presumed connections drawn in firm solid lines (unlike the broken lines used in Figure 6.2) that the general scientific world has been bamboozled into believing that evolution has been proved. Nothing could be further from the truth.

F. Hoyle and N. Wickramasinghe, Evolution from Space 87, 89 (1981). Patterson* similarly concludes:

> The diagrams in these books follow two main styles, the spindle-diagram, first

are such that now "we have even fewer examples of evolutionary transition than we had in Darwin's time,"318/ and "there is not one such fossil for which one could make a

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instituted by the pre-Darwinian Agassiz, which serves to summarize the fossil record rather than express relationships (appended vaguely, even apologetically, by broken lines and queries), and the picket-fence style, which seems to deny evolution rather than illustrate it.

Patterson*, Significance of Fossils in Determining Evolutionary Relationships, 12 Ann. Rev. of Ecology and Systematics 195, 216 (1981). Accord, Rosen*, Forey*, Gardiner* & Patterson*, Lungfishes, Tetrapods, Paleontology, and Pleisomorphy, 167 Bull. American Museum of Natural History 163, 178 (1981).

318. Raup*, Conflicts between Darwin and Paleontology, Field Museum of Natural History Bull. Jan. 1979, at 22, 25 ("By this I mean that some of the classic cases of darwinian change in the fossil record, such as the evolution of the horse in North America, have had to be discarded or modified as a result of more detailed information . . . ."). Accord, Valentine*, Darwin's Impact on Paleontology, 32 BioScience 513, 516 (1982) ("in some ways the record as we know it today provides even less obvious support for evolution via gradual change through natural selection than in Darwin's time.").

watertight case,"319/ according to geolog-

ist Raup* of the Field Museum and paleon-

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319. Letter from Dr. Colin Patterson* to Luther D. Sunderland (Apr. 10, 1979). He further describes the problem:

> Gould and the American Museum people are hard to contradict when they say that there are no transitional fossils. As a palaeontologist myself, I am much occupied with the philosophical problems of identifying ancestral forms in the fossil record. You say that I should at least 'show a photo of the fossil from which each type organism was derived.' I will lay it on the line - there is not one such fossil for which one could make a watertight argument. The reason is that statements about ancestry and descent are not applicable in the fossil record. Is Archaeopteryx the ancestor of all birds? Perhaps yes, perhaps no: there is no way of answering the question. It is easy enough to make up stories of how one form gave rise to another, and to find reasons why the stages should be favoured by natural selection. But such stories are not part of science, for there is no way of putting them to the test.

Accord, Gould*, The Return of Hopeful Monsters, Natural History, June-July, 1977, at 22, ____ ("cannot even invent a reasonable sequence of intermediate forms" for some alleged transitions"); Frazzetta*, From Hopeful Monsters to Bolverine Snakes, 104 American Naturalist 55. ____(1970).

tologist Patterson* of the British Museum. These few alleged transitional forms (in contrast to the thousands of orders, families and genera) are discussed below.320/

Yet "it should be possible to find some 'connecting links'," because "higher categories become distinct entities through extinction of intermediate related groups."321/ Darwin* recognized the significance of the problem posed by gaps,322/ and T.H. Huxley*,

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320. Section 2[a](2)(d) infra.

321. W. Stansfield*, The Science of Evolution 511 (1977). Accord, C. Darwin*, The Origin of Species _____ (1859, reor. 1967). Transitional forms should often exexist in the fossil record if macroevolutionary changes take 100 million years or so, and if the establishment of a mutation in a population takes on the average 10 million years. J. Huxley*, Evolution in Action 13 (1967); Wald*, Discussion, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution _____, _____ (P. Moorehead & M. Kaplan eds. 1967).

322. C. Darwin*, The Origin of Species 255, 275 (1859, repr. 1959); Raup*, Conflicts between Darwin and Paleontology, Field Museum of Natural History Bull., Jan. 1979, at 22, 22-23 ("Darwin was completely

probably his chief supporter, conceded that "if it could be shown that this fact had always existed, the fact would be fatal to the doctrine of evolution."323/ Biological macroevolutionists have proposed two major solutions.

One defense raised by Darwin* and many macroevolutionists is the "incompleteness of the fossil record." However, now that 200 million fossil specimens have been cataloqued of over 250,000 fossil species, the fossil record cannot really be called inadequate, as paleontologist Stanley* of Johns

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aware of this. He was embarrassed by the fossil record because it didn't look the way he predicted it would and, as a result, he devoted a long section of his Origin of Species to an attempt to explain and rationalize the differences. There were several problems, but the principal one was that the geologic record did not then and still does not yield a finely graduated chain of slow and progressive evolution. In other words, there are not enough intermediates.").

323. T. Huxley*, Three Lectures on Evolution 619 (1882).

Hopkins and others argue:

> In part, the role of paleontology in evolutionary research has been defined narrowly because of a false belief, tracing back to Darwin and his early followers, that the fossil record is woefully incomplete. Actually, the record is of sufficiently high quality to allow us to undertake certain kinds of analysis meaningfully at the level of the species.324/

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324. S. Stanley*, Macroevolution 1 (1979). He notes the cynical notion in paleontology "that wherever in the fossil record one is looking happens to be where phyletic evolution is not recorded." Id. at 88. Hoyle and Wickramasinghe also describe the weakness of the defense that the fossil record is flawed and the "myth" that macroevolution is well proved by that fossil record:

> It is not hard to find writings in which the myth is stated that the Darwinian theory of evolution is well proven by the fossil record. But one finds that the higher the technical quality of the writing the weaker the claims that are made. The imperfections (discussed in Chapter 6) are blamed in even the best texts, however, on the incompleteness of the fossil record. Yet if one persists by consulting the geological literature the truth eventually emerges. The fossil record is highly imperfect from a Darwinian point of view, not because of the inadequacies of geologists, but because the slow evolutionary connections re-

Another defensive approach taken by many macroevolutionists is to identify purported common "ancestral groups" because of the absence of actual fossils of common ancestors or transitional forms. However, postulations about "such groups are inconsistent with evolutionary theory," according to paleontologist Patterson*.325/ Also, talk about ancestral groups is highly con-

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quired by the theory did not happen. F. Hoyle & N. Wickramasinghe, Evolution from Space 147 (1981). Accord, E. Russell*, The Diversity of Animals 130 (1962) ("the Mammals, whose geological history is comparatively well documents"); F. Hoyle, The Intelligent Universe 43 (1983) ("Over ten thousand fossil species of insects have been identified over thirty thousand species of spiders, a similar numbers for many sea-living creatures."); see also D. Raup* & S. Stanley*, Principles of Paleontology 303 (2d ed. 1978) ("data for genera and families are numerous enough to allow for meaningful analysis.").

325. Patterson*, Significance of Fossils in Determining Evolutionary Relationships, 12 Ann. Rev. of Zoology and Systematics 195, 207 (1981). He describes the problem further:

> Evolutionary paleontologists have

jectural, in imagining a relationship be-

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offered three responses to criticisms of ancestral groups. First, that grouping by phenetic similarity (as in forming paraphyletic groups) reflects genotypic similarity, and is therefore a valid reflection of evolutionary relationships. This argument has been refuted above. Second, that ancestral groups are approximations, "with the admission that evidence available at present is insufficient to make a more specific statement" (30); the rank assigned to such groups "symbolizes the degree of confidence which one has in a hypothesis about phylogeny" (8). This response seems to reflect only the inductivist view so long prevalent among paleontologists--"we need more fossils before we shall know the answer." Third, paraphyletic groups are "adaptively unified" (97). While this may be true of some such groups (as some may be "phenetically" unified), it cannot serve as a general justification. No one can argue that Invertebrata (a paraphyletic group) are adaptively unified.

Id. Accord, W. Thompson*, The Status of Species, in Philosophical Problems in Biology at ___, 69 (V. Smith ed. 1966)("The so-called ancestral insect is simply a mental construct. That we can produce from it, by modifying it in various ways, all the forms whose descent we are investigating, is in no way surprising, because it has been built for this purpose. The biological prestidigitator is simply taking out of the hat

tween what may be totally unrelated groups.326/

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the rabbits he put into it. The method used in working out the descent is, in fact, a perfect example of the argument in a circle.").

326. Rosen*, Forey*, Gardiner* & Patterson*, Lungfishes, Tetrapods, Paleontology, and Pleisomorphy, 168 Bull. American Museum of Natural History 163, 178 (1981) ("The search for fossils has produced superficially acceptable sequences, as it was bound to, for few transformations, however fantastic, are forbidden by the Darwinian or Neo-Darwinian picture of the evolutionary process. Yet the sequences consist of nothing more than abstractions from paraphyletic groups such as rhipidistians, osteolepiforms, and labyrinthodonts."); Hull*, Thirty-One Years of Systematic Zoology , 32 Systematic Zoology 315, 333-35 (1983); Patterson*, Significance of Fossils in Determining Evolutionary Relationships, 12 Ann. Rev. of Ecology and Systematics 195, 218 (1981) ("Most fossil-based theories of relationship concern such [extinct nonancestral] groups. The superficial attraction of these stories, apparent illumination of the history of life, has bolstered the belief that fossils determine evolutionary relationships. Yet extinct paraphyletic groups seem to me to obscure rather than illuminate relationships, for they exist not in nature but in the minds of evolutionists. Such groups lead to a sterile inversion of problems of relationships, which come to depend not on comparative analysis of what is accessible-the Recent biota--but on juggling with what is inaccessible--uncharac-

Thus, the paleontology argument for biological macroevolution is weak if not contrary, and this poses a material factual issue about the noncompelling nature of evolution and the scientific nature of creation-science.

(ii) Phylogeny Argument and Problems. The phylogeny argument329/ for macroevolu-

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terizable abstractions from the fossil record."); Patterson* stresses that "fossils may tell us many things, but one thing they can never disclose is whether they were the ancestors of anything else." C. Patterson*, Evolution 133 (1978).

Gould* gives the important reminder about transitional forms, which applies equally to common ancestral forms, that "a plausible story is not necessarily a true one. And, in any case, the issue is not, can preadaptation save gradualism in some cases, but rather, does it permit us to invent a tale of continuity in most or all cases?" Gould*, The Return of Hopeful Monsters, Natural History, June-July 1977, at 22, ___.

329. A "phylogeny" is a "sequence of ancestor-descendant forms." F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 441 (1979). Accord, T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 262 (1977).

tion is based on "phylogenetic trees" of assumed evolutionary descent.330/ This field of systematics" is the very cornerstone of evolutionary analysis."331/ The specific phylogenies that are alleged to have been documented, such as the horse series and the ape-like ancestor-to-man transition, are discussed later.332/

One problem with the phylogeny argument is that reconstruction of phylogenies is

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330. D. Raup* & S. Stanley*, Principles of Paleontology 13132 (2d ed. 1978). Some specialists use evolutionary "bushes."

331. Cracraft*, Systematics, Comparative Biology, and Creationism, in Scientists Confront Creationism ____, 177 (L. Godfrey ed. 1983). Accord, Leith*, Are the Reports of Darwin's Death Exaggerated?, 166 The Listener 390, 390 (1981)("all one can learn about the history of life is learned from systematics"--the "rest of it is storytelling"). "Systematics" is "the scientific study of the kinds, diversity, and similarities of organisms and of the relationships among them" (including phylogenies). W. Stansfield*, The Science of Evolution 98 (1977).

332. Section 2[a](2)(d) infra.

impossible in the professional opinion of many noncreationist scientists in the field:

> The chief question with respect to phylogenetic reconstruction has always been its feasibility. Throughout the history of "Systematic Zoology," a series of objections have been raised to it, starting with Blackwelder, Bigelow, Boyden, and Borgmeier, continuing with the pheneticists, and culminating with at least some cladists.333/

The rejection of phylogenies--and of macroevolution itself--by many pheneticists and cladists is discussed in the next Section.334/

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333. Hull*, Thirty-One Years of Systematic Zoology, 32 Systematic Zoology 315, 333-35. Accord, Nelson*, _____, 21 Systematic Zoology ___, 368 (1972) "Hennigian relationships embody the principles that all common ancestral species are necessarily hypothetical, and that ancestral species, although they may be reconstructed (e.g., Fitch, 1971), will forever remain unknown and unknowable in a directly empirical sense (e.g., in the sense that species are 'known' by way of inference from observation of study material.)").

334. Sections 2[a](2)(a)(v) supra and 2[a](2)(c)(iii) infra. For example, most transformed cladists question phylogenies as based on "flawed artefacts" and questionable assumptions:

> Because of all these problems, it

Another serious difficulty, related to the first, is that phylogenies are almost totally speculative. Bonner* says that those in textbooks "are, as a rule" a festering mass of unsupported assertions."335/ Ghiselin* concludes that many "read like imaginative literature" and "fill gaps in the data with speculations."336/ Boyden* observes

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> is rare to find palaeontologists offering ancestral species, or doing so with any conviction. Instead, they usually propose "ancestral groups", as approximations to the truth, with the claim that the true ancestor, if found, would fall within the group. . . . Yet these flawed artefacts play a central role in phylogenies--accounts of the evolutionary descent of lineages. This raises yet another problem, for groups cannot evolve--species are the largest units capable of change. Thus cladistics calls into question much of conventional evolutionary history.

Patterson*, Cladistics and Classification, New Scientist 303, 306 (1982). Accord, Ball*, On Groups, Existence and the Ordering of Nature, 32 Systematic Zoology 446, 446 (1983).

335. Bonner*, Book Review, 49 American Scientist 240, ___ (1961).

that "phylogenies grew up like weeds" for "even organisms with no fossils available."337/ Charig* calls some "meaningless waffle," Turrill* calls most "extremely doubtful approximations," and Sokal* calls many "utter rubbish."338/ The gross subjectivity of postulated phylogenies is evident in the treatment of the fossil record as inadequate when the fossils do not fit the phylogenetic hypotheses, but as adequate

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336. Ghiselin*, Models in Phylogeny, in Models in Paleobiology _____, 131 (T. Schopf ed. 1972) ("Nonetheless it is true that many works on phylogeny do read like imaginative literature rather than science. A disproportionate segment of the literature seeks to fill gaps in the data with speculations and nothing more.").

337. A. Boyden*, Perspectives in Zoology 117 (1973).

338. Charig*, Systematics in Biology: A Fundamental Comparison of Some Major Schools of Thought, in Problems of Phylogenetic Reconstruction 411-412 (1982); W. Turrill*, Joseph Dalton Hooker 213 (1963); Sokal* & Sneath*, _____ (1963). Accord, Rosen* & Schuh*, Book Review, 24 Systematic Zoology 504, 505 (1975).

when the fossils apparently support the phylogenetic hypotheses.339/

A further problem, closely related to the preceding ones, is that phylogenies are used to support macroevolution through circular reasoning:

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339. Patterson*, Book Review, 29 Systematic Zoology 216, 216 (1980) ("But when a new fossil is found and is inconsistent with the phylogeny (like Ichthyostega), the stratopheneticist's answer is that this test has shown that the fossil record was insufficiently dense and continuous for the method to work. And when a new fossil is consistent with the phylogeny, the record was sufficiently dense and continuous. Plainly, the method is hard to fault, for the fossil record, rather than the phylogeny, is under test (cf. Nelson, 1978). My overall impression is that Gingerich's method is fine when the paleontologist is willing to specify ancestral species, but stultifying, even pernicious, when he specifies phenetically defined ancestral (paraphyletic) groups such as rhipidistians, anthracosaurs, thecodonts, and therapsids.") See also, Forey*, Neontological Analysis Versus Paleontological Stories, in Problems of Phylogenetic Reconstruction 119, 143 (K. Joysey & A. Friday eds. 1982).

> any reasonably graded series of forms can be thought to have legitimacy. In fact, there is circularity in the approach that first assumes some sort of evolutionary relatedness and then assembles a pattern of relationships from which to argue that relatedness must be true. This interplay of data and interpretation is the Achilles' heel of the second meaning of evolution.340/

A crowning problem is that the quest for phylogenies has failed:

A. The Commitment in Theory. Dar-

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340. Thomson*, Marginalia: The Meanings of Evolution, 70 Am. Scientist 529, 529-30 (1982). Accord, Forey*, Neontological Analysis Versus Palaeontological Stories, in Problems of Phylogenetic Reconstruction 119, 124 (K. Joysey & A. Friday eds. 1982) ("Evolutionary taxonomy, on the other hand, assumes that the pattern is due to evolutionary theory and so the construction of trees must, of necessity, have regard to evoutionary theory . . . The problem is that both are ultimately derived from the theory of evolution: the fossil record being interpreted in the light of population biology theory and expresssed as ancestor-descendent relationships (Simpson 1953)."); Cartmill*, Hypothesis Testing and Phylogenetic Reconstruction, in Zeitschrift fur Zoologische Systematik und Evolutions forschung 73, 90 (1981) ("a phylogenetic hypothesis" is intertwined with "assuming certain premises--evolutionary laws").

winian theory asserts that physical descent with modification has been universal, which means that every modern species is the latest link in a phylogeny. There must therefore have been hundreds of thousands of phylogenies, and it was Darwin's expectation that these would be found. His followers, sharing his expectation, felt a duty to seek and find the phylogenies.

B. Another Miserable Failure. The expectations were vain. The zeal came to naught. In the 125 years since the Origin was published, nothing has been accomplished. No phylogenies have been established and the pursuit of them has fallen into disrepute. The following authorities attest to this.341/

Thus, the phylogeny argument for biological macroevolution is viewed by many non-creationist scientists as impossible, total-

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341. E. Seiff* & N. Macbeth*, Evolution (unpublished ms. 1982). Accord, Patterson*, Significance of Fossils in Determining Evolutionary Relationships, 12 Ann. Rev. of Ecology and Systematics 195, 213 (1981); Macbeth, A Third Position in the Textbook Controversy, 38 American Biology Teacher 495, 495 (Nov. 1976) ("The whole aim and purpose of Darwinism is to show how modern forms descended from ancient forms, that is, to construct reliable phylogenies (genealogies or family trees). In this it has utterly failed.").

ly speculative, circular, and unsuccessful. This constitutes a material factual issue about the noncompelling nature of evolution and the scientific nature of creation-science.

(iii) Classification Argument and Problems. The classification (taxonomy) argument342/ for macroevolution is based on the hierarchical structure or groupings in nature. There are "three prevailing systems of classification, known as phenetic, cladistic, and evolutionary."343/

The most basic problem with the classification argument is that most of one school (transformed cladists) and much of another

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342. "Classification," or "taxonomy," is "the theory and practice of naming, describing, and classifying organisms." W. Stansfield*, The Science of Evolution 98 (1977).

343. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 262 (1977). Accord, S. Luria*, S. Gould* & S. Singer*, A View of Life 684 (1981).

school (pheneticists) deny that classification supports or is even relevant to evolution. "In 'transformed cladistics' . . . evolution is deliberately ignored, being considered unproven and possibly unprovable," according to a leading advocate.344/

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344. Charig*, Cladistics: A Different Point of View, in Evolution Now 121, 121 (J. Maynard-Smith ed. 1982). Accord, Platnick*, Philosophy and the Transformation of Cladists, 28 Systematic Zoology 537, 537 (1979) ("neither the value nor the success of the methods is limited by the value or success of that evolutionary model."); Patterson*, The Goals, Uses, and Assumptions of Cladistic Analysis (1981), quoted in Beatty, Classes and Clades 31 Systematic Zoology 35, 31 (1982) ("As I understand it, cladistics is theoretically neutral so far as evolution is concerned. It has nothing to say about evolution. You don't need to know about evolution, or believe in it, to do cladistic analysis."); Patterson*, Cladistics and Classification, ___ New Scientist 303, 304 (1982)("But it is possible to look at diagrams like Figure 3, and at the definitions Hennig associated with them , in a more general framework, one which has no evolutionary implications. Branching diagrams can be seen not as evolutionary trees, but as cladograms in which there is no time scale and the nodes simply shared characteristics (synapomorphies) rather than common ancestry.").

It generally operates "in a nonevolutionary domain," according to a critic.345/ Similarly, in the phenetics school, "some more radical numerical taxonomists have abandoned the goal of building a taxonomy that reflects evolutionary descent."346/ In the view of these specialists, the groupings in nature do not support macroevolution but instead are irrelevant to it.

A related problem is that essentially the same classification system was histori-

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345. Ball*, On Groups, Existence and the Ordering of Nature, 32 Systematic Zoology 446, 446 (1983). Accord, Beatty*, Classes and Cladists, 31 Systematic Zoology 25, 29 (1982) ("Apparently in response to the perceived crisis in evolutionary biology, cladists have taken more or less extreme measures to sever their ties to that discipline."); Beatty*, id. at 31 ("But pattern cladistics is not, after all, evolutionarily neutral. It is at odds with evolutionary thinking."); Patterson*, Cladistics and Classification, ____ New Scientist 303, 306 (1982) ("Thus cladistics calls into question much of conventional evolutionary history.").

346. S. Luria*, S. Gould* & S. Singer*, A View of Life 676 (1981).

cally founded and developed by creationist scientists (Linnaeus and others), and was defended as more consistent with creation than with evolution by many scientists at the time of Darwin* (Agassiz, Sedgwick, and others).347/ In fact, this pre-Darwinian classification system "has undergone surprisingly little change in the times following it, and such changes as have been made have depended only to a trifling extent on . . . phylogenetic relationships" proposed by macroevolution.348/ Thus, classification

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347. W. Stansfield*, The Science of Evolution 99 (1977); Dobzhansky*, Evolution, in 10 Encyclopedia Americana 734, 734 (1982); C. Patterson*, Evolution, 121-22 (1978).

348. E. Mayr*, Systematics and the Origin of Species 276 (1942) ("The fact is that the classification of organisms that existed before the advent of evolutionary theories has undergone surprisingly little change in the times following it, and such changes as have been made have depended only to a trifling extent on the elucidation of the actual phylogenetic relationship through paleontological evidence. The phylogentic interpretaion has been simply superimposed

does not really provide an argument in favor of macroevolution.

Another weakness, of the evolutionary school of classification, is that the use of classification to support macroevolution involves circular reasoning because "[classifications are designed primarily, we are

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on the existing classification; a rejection of the former fails to do any violence to the latter. The subdivisions of the animal and plant kingdoms established by Linnaeus are, with few exceptions, retained in the modern classification, and this despite the enormous number of new forms discovered since then. The new forms were either included in the Linnaean groups, or new groups have been created to accommodate them. There has been no necessity for a basic change in the classification."). Accord, Simpson*, The Principles of Classification and the Classification of Mammals, 85 Bull. Am. Museum of Natural History 4 (1945)("classification continued to develop with no immediate evidence of revolution in principles."); Blackwelder, Twenty-Five Years of Taxonomy, 26 Systematic Zoology 107, 134 (1977) ("Evolutionary taxonomy never has been really different from classical taxonomy, in spite of all the fireworks."); N. Macbeth*, Darwin Retried 20 (1971) ("the charts of relationship were pretty much the same no matter what theory the classifier believed in.").

so often told, to 'state,' or 'reflect,' or 'be consistent with,' evolutionary and genetic relationships."349/ Further, a "classification based on the idea of phylogenetic descent must at best remain highly speculative, for, save in a few fossil lineages, we do not and cannot know the actual course of events in the evolution of a group," as Huxley* noted.350/ The very categories used in classification, other than the species, "are still artificial groupings" that are nonobjective.351/ Finally, the "two sources of information are often contradictory" that are used by the evolutionary school of classification.352/

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349. Kitts*, Karl Popper, Verifiability, and Systematic Zoology, 26 Systematic Zoology 185, 190 (1977). Accord, S. Gould*, Hen's Teeth and Horse's Toes 355 (1983).

350. J. Huxley*, Evolution: The Modern Synthesis 394-95 (1942).

351. W. Stansfield*, The Science of Evolution 510-11 (1977) ("higher categories

Thus, the classification argument for biological macroevolution is that classification is not scientifically or historically relevant to macroevolution, and only supports macroevolution through circular rea-

(genera, families, orders, classes, phyla, and even kingdoms), though they do represent greater levels of evolutionary divergence, are still artificial groupings made by humans for convenience in taxonomic work. They are not natural groups the way that species are."). Accord, D. Raup* & S. Stanley*, Principles of Paleontology 135, 136, 138 (2d ed. 1978) ("The family, on the other hand, has no comparable objective basis. Higher categories are used to express evolutionary relationships but we do not have, in the present state of our understanding, specific rules that can be applied. In other words, there are no thresholds in the transition from genus to family comparable to the threshold between the subspecies and the species (at a single moment in time)."); Richards*, Book Review, 167 Science 1477, 1477 (1970) ("I think nearly all biologists must share, the species is the only taxonomic category that has at least in more favorable examples a completely objective existence. Higher categories are all more or less a matter of opinion."); N. Macbeth*, Darwin Retried (1971).

352. S. Luria*, S. Gould* & S. Singer*, A View of Life 763-64 (1981).

soning. This raises a material factual issue about the noncompelling status of evolution and the scientific content of creation-science.

(iv) Comparative Anatomy Argument and Problems. The comparative anatomy argument 354/ for macroevolution is based on the similarity of structure of various organisms, which evolutionists interpret to show common ancestry. The comparative anatomy evidence that is anomalous, in the sense of indicating the unrelatedness or distinct ancestry of organisms, has been discussed above.355/ The comparative anatomy argument is constructed on a problematic foundation.

This basic problem is that similar ana-

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354. "In comparative anatomy we try to discern genetic affinities as expressed in adult structures rather than in embryological structures." W. Stansfield*, The Science of Evolution 113, 116 (1977).

355. Section 2[a](1)(f)(ii) supra.

tomy does not necessarily indicate common ancestry and evolutionary descent. Nearly all evolutionist scientists acknowledge that the relation is only circumstantial and that there are many convergences (anatomical similarities that do not reflect common ancestry):

> such general resemblances in protoplasmic systems as we find in all living organisms do not necessarily mean genetic relationship. Rather, such resemblances may be fundamentally convergent, and represent only the minimum requirements or "conditions of existence" which all living systems must possess.356/

In fact, the assumption that similar anatomy indicates common ancestry is generally wrong,

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356. A. Boyden*, Perspectives in Zoology 27 (1973). Boyden* is a professor of zoology at Rutgers University. Accord, Patterson*, Significance of Fossils in Determining Evolutionary Relationships, 12 Ann. Rev. of Ecology and Systematics 195, 217 (1981) ("Such hypotheses are untestable by morphology alone, which cannot discriminate descent from common ancestry, or from non-evolutionary relationship."); N. Macbeth*, Darwin Retried 13, 16 (1971).

because the genes that produce the similar anatomical structures are generally not identical (homologous), as de Beer* points out:

> It is now clear that the pride with which it was assumed that the inheritance of homologous structures from a common ancestor explained homology was misplaced; for such inheritance cannot be ascribed to identity of genes. The attempt to find homologous genes has been given up as hopeless. . . . It is useless to speculate on any explanation in the absence of facts.357/

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357. G. de Beer*, Homology: An Unsolved Problem 15 (1971). Accord, S. Zuckerman*, Beyond the Ivory Tower 54 (1970) ("We now know that this view is far too simple, since relationships which are inferred on the basis of comparative antomy may not necessarily correspond to true genetic relationships. Nevertheless, lack of other information makes it inevitable that the bulk of our views about evolutionary relationships has to be based on the evidence of structure. Consequently, students of comparative anatomy need to exercise great forbearance, as well as great humility, both in the area of fact and in that of interpretation, simply because the inferences they draw about evolution are in the final analysis speculations--specula-

The alleged relation between similar anatomy and common ancestry is generally rejected by transformed cladists, who classify organisms by similar anatomical features (synapomorphy) and yet argue that they "need have no evolutionary implications."358/ Finally, this alleged relation to common ancestry is contradicted by the history of comparative anatomy, because the creationist "Linnaeus, the father of systematic biology" established the classification system by grouping organisms that "resemble one another in body structure" (anatomy), but "did not interpret this propinquity as a consequence of commmon descent.359/ The creationist sci-

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tions that can only be checked by recourse to the facts from which they are derived."); A. Boyden*, Perspectives in Zoology 27 (1973).

358. Patterson*, Significance of Fossils in Determining Evolutionary Relationships, 12 Ann. Rev. of Ecology and Sytematics 195, 208 (1981). Accord, Patterson*,

entist Owen then developed the basis of comparative anatomy, while disagreeing that it has any evolutionary implications:

> The central concept of comparative anatomy is homology, a term introduced by Sir Richard Owen, the first director of the British Museum (Natural History), London, and a powerful anti-evolutionist.360/

Thus, the comparative anatomy argument for biological macroevolution provides little support (and the widespread anomalies better support biological creation). This is a material factual issue about the non-compelling nature of evolution and the scientific nature of creation-science.

(v) Comparative Embryology Argument and Problems. The comparative embryology

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Cladistics and Classification, ____ New Scientist 303, 304 (1982) ("the nodes simply imply shared characteristics (synapomorphies) rather than common ancestry.").

359. Dobzhansky*, Evolution, in 10 Encyclopedia Americana 734, 734 (1982). Accord, Patterson*, Cladistics and Classifi-

argument361/ for macroevolution arises from the similarity of development of organs and tissues in various organisms, which evolutionists view as reflecting common ancestry and descent.

First, the "'biogenetic law' is now thoroughly discredited," although it was stressed by early Darwinists in saying that "the embryological development (ontogeny) of an organism repeats (recapitulates) the evolutionary history (phylogeny) of its species."362/ Haeckel*, the formulator of

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cation, ____ New Scientist 303, 303 (1982) ("Comparative anatomy developed as a means of searching out these ideal plans.").

360. C. Patterson*, Evolution 121-22 (1978).

361. "The science of embryology is concerned with the cause and effect relationships that lead to differentiation of tissues, organs, and organ systems." W. Stansfield*, The Science of Evolution 103 (1977). Accord, D. Raup* & S. Stanley*, Principles of Paleontology 354 (2d ed. 1978).

362. W. Stansfield*, The Science of Evolution 104 (1977) (the biogenetic law

the "biogenetic law," supported it with

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was stated by Haeckel* and others as that "ontogeny recapitulates phylogeny"). Accord, D. Raup* & S. Stanley*, Principles of Paleontology 354 (2d ed. 1978) ("largely in error"); P. Ehrlich* & R. Holm*, The Process of Evolution 66 (1963) ("Its shortcomings have been almost universally pointed out by modern authors, but the idea still has a prominent place in biological mythology."); Danson*, Evolution 49 New Scientist 35, ____ (1971); ("intellectually barren"); Olson*, Evolution of Life, Nature April 24, 1965, at 331, ____("providing further evidence against the 'biogenetic law' of recapitulation in Haeckel's sense"); Bock*, Book Review, 164 Science 684, 684 (1969) ("demonstrated to be wrong by numerous subsequent scholars"); G. de Beer*, Embryos and Ancestors _____(3d ed. 1958). Bock* writes of the biogenetic law:

> the biogenetic law was widely accepted by biologists and served as the basis for the surge of embryological research that continues unabated to this day. Moreover, the biogenetic law has become so deeply rooted in biological thought that it cannot be weeded out in spite of its having been demonstrated to be wrong by numerous subsequent scholars. Even today both subtle and overt uses of the biogenetic law are frequently encounterd in the general biological literature as well as in more specialized evolutionary and systematic studies.

fradulent drawings.363/

Second, the modern embryological argument shares the same foundational problem as the comparative anatomy argument, with which it is "very closely related"364/: that similar embryological development does not necessarily indicate common ancestry and evolutionary descent.365/

Bock*, Book Review, 164 Science 684, 684 (1969). Bock was a professor of biology at Columbia University.

363. Assmusth* & Hull*, Haeckel's Frauds and Forgeries (1911). Haeckel* was convicted for forgeries in a German court. See also C. Singer*, A History of Biology 487 (1931)("His faults are not hard to see. For a generation and more he purveyed to the semi-educated public a system of the crudest philosophy--if a mass of contradictions can be called by that name. He founded something that wore the habiliments of a religion, of which he was at once the high priest and the congregation.").

364. W. Stansfield*, The Science of Evolution 113 (1977) ("The two disciplines of comparative anatomy and comparative embryology are very closely related and could be treated under a general heading of 'comparative development' . . ..").

365. Section 2[a](2)(c)(iv) supra.

Third, the vestigial organ aspect of this embryology argument, that useless modern organisms are vestiges of once-useful evolutionary stages, is incorrect, as zoologist Scadding* notes:

> An analysis of the difficulties in unambiguously identifying functionless structures and an analysis of the nature of the argument, leads to the conclusion that 'vestigial organs' provide no evidence for evolutionary theory.
>
> I would suggest that the entire argument that vestigial organs provide evidence for evolution is invalid on two grounds, one practical, the other more theoretical. The practical problem is that of unambiguously identifying vestigial organs, i.e., those that have no function. The analysis of Wiedersheim's list of vestigial organs points out the difficulties. As our knowledge has increased the list of vestigial structures has decreased. Wiedersheim could list about one hundred in humans; recent authors usually list four or five. Even the current short list of vestigial structures in humans is questionable. . . . Similarly, for other 'vestigial organs' there is reasonable grounds for supposing that they are functional albeit in a minor way. . . . The other major objections to citing vestigial organs as evidence of evolution is a more theo-

> retical one based on the nature of the argument. The 'vestigial organ' argument uses as a premise the assertion that the organ in question has no function. There is no way however, in which this negative assertion can be arrived at scientifically. . . . Since it is not possible to unambiguously identify useless structures, and since the structure of the argument used is not scientifically valid, I conclude that 'vestigial organs' provide no special evidence for the theory of evolution.366/

The alleged vestigial organs--such as human "gill slits" (which do not exist), male nipples, Woffian and Mullerian ducts, tonsils, appendix, coccyx ("tail bone"), thy-

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366. Scadding*, Do "Vestigial Organs" Provide Evidence for Evolution?, 5 Evolutionary Theory 173, 173, 175, 176 (1981). See also A. Romer*, The Vertebrate Body 283-84 (1965) ("We see in this story the development in the amniote embryo of three successive kidney structures--pronephros, mesonephros, metanephros. It is often stated or implied that these three are distinct kidneys and which have succeeded one another phylogenetically as they do embryologically. Upon consideration, however, it will be seen that there is no strong reason to believe this. The differences are readily explainable on functional grounds . . ..").

mus, and facial muscles--have been found to have functions and not to be vestigial.367/

Thus, the comparative embryology argument for biological macroevolution also offers little support. This is a material factual issue about the noncompelling nature of evolution and the scientific nature

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367. J. Langman*, Medical Embryology 262 (3d ed. 1975). ("Since the human embryo never has gills--brachia--the term pharyngial arches and clefts has been adopted for this book."); Scadding*, _____, 5 Evolutionary Theory 173-76 (May 1981) ("A fourth category of vestigial organs would be those that are the vestiges of the reproductive structures of the opposite sex, e.g., nipples in men, vestiges (in the female) of the Wolffian duct, and (in the male) of the Mullerian ducts. These structures, however, clearly reflect the embryonic development of a sexually dimorphic organism which begins its development in a sexually indifferent condition with structures characteristic of both sexes. They certainly do not reflect phylogenetic development. No one supposes males evolved from females or vice versa. On the basis of this analysis, I would suggest that Wiedersheim was largely in error in compiling his long list of vestigial organs. Most of them do have at least a minor function at some point in life.").

of creation-science.

(vi) Comparative Biochemistry Argument and Problems.

The comparative biochemistry argument370/ for macroevolution invclves the similarity of hemoglobin, cytochrome c, insulin, and other molecules in various organisms, which evolutionists interpret to show common ancestry and descent.371/ The comparative biochemistry evidence that is anomalous, in the sense of indicating significant differences between allegedly closely related organisms, is so widespread that it instead supports the unrelatedness or distinct ancestry of families/genera of organisms, as discussed above.372/ The compar-

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370. "Comparative biochemistry" involves "homologies at the molecular level" that reflect "the degree of genetic relationship [in which] evolutionary lineages are optimally expressed." W. Stansfield*, The Science of Evolution 125 (1977).

371. Id. at 125-27.

372. Section 2[a](1)(f)(iii) supra.

ative biochemistry argument, like the other comparative arguments, in any event is based on the problematic assumption that similarities between organisms reflect common ancestry rather than engineering design or basic conditions for life:

> It could be argued that the universality of a common ancestral population but does not in any sense prove it since the same basic reaction patterns may be required for all life.372a/

Thus, the comparative biochemistry argument for macroevolution backfires, providing a material factual issue about the noncompelling nature of evolution and the scientific nature of creation-science.

(vii) Population Genetics Argument and and Problems.

The population genetics argument373/

372a. D. Kenyon* & G. Steinman*, Biochemical Predestination 4-5 (1969) (the authors interpret this as allowing multiple origins of the first living forms.).

373. "Populations genetics" is "concerned with a detailed description of the

for macroevolution is founded on extrapolation of small changes in gene frequencies in a population to major transformations from a common ancestor to evolutionary descendants. This extrapolation is questionable, and in fact has failed.

First, population genetic changes (microevolution) tell nothing about macroevolution or even the origin of species, as Lewontin* of Harvard and Grassé* of France (its leading zoologist) observe:

> It is an irony of evolutionary genetics that, although it is a fusion of Mendelism and Darwinism, it has made

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genetic structure of a population and with changes over a shorter time scale." J. Roughgarden*, Theory of Population Genetics and Evolutionary Ecology ___ (1979). "Perhaps the most important source of evidence in support of the theory of evolution comes from the science of genetics and its manifold subdisciplines (including cytogenetics, biometrics, population genetics, etc.)" W. Stansfield*, The Science of Evolution 129 (1977).

374. R. Lewontin*, The Genetic Basis of Evolutionary Change 159 (1974).

> no direct contribution to what Darwin obviously saw as the fundamental problem: the origin of species.374/

> To assert that population dynamics gives a picture of evolution in action is an unfounded opinion, or rather a postulate, that relies on not a single proved fact showing that transformations in the two kingdoms have been essentially linked to changes in the balance of genes in a population. . . . as for seeking in it proof of the formation of new species, there is no such hope.375/

Similar observations have been made by Rosen*, Mayr*, Speiss*, Saunders* & Ho*,376/

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375. P. Grassé*, Evolution of Living Organisms 170 (trans. 1977).

376. Rosen*, Book Review, 27 Systematic Zoology 370, 372 (1978) ("Population genetics, in other words, cannot, and does not purport to, explain the origin and epigenetic history of new codons. Its focus is entirely on the relation of genetic equilibria to ecological discontinuities and fluctuations."); Mayr*, Prologue, in The Evolutionary Synthesis 1, 11 (E. Mayr* & W. Provine* eds. 1980) ("Naturalists repeatedly objected that they could not see any connection between changes in gene frequences, described by the geneticists, and the evolutionary events at the hierarchical levels of species and higher taxa. As recently as 1973 this is perhaps the most cogent objection against population genetics raised by

and indirectly by all the evolutionist scientists who object to extrapolation from microevolution to macroevolution.377/

Second, population genetics has failed to explain anything, as Lewontin* concludes and Roughgarden* concurs:

Grassé.") (Mayr* is not describing his personal view); E. Speiss*, Genes in Populations ___ (1977) ("Speciation is one of the most critical processes in nature, but we are a long way from describing the origin of species in the field or with methods of experimental population genetics."); Saunders* & Ho*, Is Neo-Darwinism Falsifiable? --And Does it Matter?, 4 Nature and System 179, 185 (1982) ("If population genetics, including Weismann's doctrine of the independence of the germ plasm, is considered as part of neo-Darwinism, then that part may be falsifiable. It is not, however, a theory of evolution.").

377. Section 2[a](2)(b) supra. E.g., Stanley*, A Theory of Evolution Above the Species Level, 72 Proc. National Academy of Science 646, 648, 650 (1975) ("We must turn not to population genetic studies of established species, but to studies of speciation and extinction in order to decipher the higher-level process that governs the general course of evolution.").

The theory explains nothing because it explains everything. It is my contention that a good deal of the structure of evolutionary genetics comes perilously close to being of this sort.

For many years population genetics was an immensely rich and powerful theory with virtually no suitable facts on which to operate. It was like a complex and exquisite machine, designed to process a raw material that no one had succeeded in mining. Occasionally some unusually clever or lucky prospector would come upon a natural outcrop of highgrade ore, and part of the machinery would be started up to prove to its backers that it really would work. But for the most part the machine was left to the engineers, forever tinkering, forever making improvements, in anticipation of the day when it would be called upon to carry out full production.

Quite suddenly the situation has changed. The mother-lode has been tapped and facts in profusion have been poured into the hoppers of this theory machine. And from the other end has issued--nothing. It is not that the machinery does not work, for a great clashing of gears is clearly audible, if not deafening, but it somehow cannot transform into a finished product the great volume of raw material that has been provided. The entire relationship between the theory and the facts needs to be reconsidered.378/

Finally, and related to its failure,

population genetics uses circular reasoning when it is used to support evolution, as Forey* argues:

> The hope of many of the authors of trees is that the synthetic approach (Bock 1974) will combine the analysis of pattern with the theories of the population biologists/geneticists in mutual support. The problem is that both are ultimately derived from the theory of evolution: the fossil record being interpreted in the light of population biology theory and expressed as ancestor-descendent relationships (Simpson 1953). One might remark that, far from being mutually supportive,

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378. R. Lewontin*, The Genetic Basis of Evolutionary Change 11-12 (1974). Accord, J. Roughgarden*, Theory of Population Genetics and Evolutionary Ecology ___(1979) ("When research into population genetics was begun, it was assumed that these kinds of longterm evolutionary phenomena would be explained as a result. We need to reassess the relevance of population genetics to these kinds of evolutionary issues."); R. Lewontin*, The Genetic Basis of Evolutionary Change 267 (1974) ("How can such a rich theoretical structure as population genetics fail so completely to cope with the body of fact? Are we simply missing some critical revolutionary insight . . .? Or is the problem more pervading, more deeply built into the essence of our science? I believe it is the latter.").

this is merely "the blind leading the blind".379/

Thus, the population genetics argument for macroevolution has failed. This is a material factual issue about the noncompelling nature of evolution and the scientific nature of creation-science.

(viii) Artificial Selection Argument and Problems. The artifical selection argument380/ for macroevolution is based on extrapolation from breeding experiments (artificial selection) to natural selection

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379. Forey*, Neontological Analysis Versus Palaeontological Stories, in Problems of Phylogenetic Reconstruction 119, 124 (K. Hoysey* & A. Friday* eds. 1982).

380. "Artificial selection" means controlled breeding by human direction. "[M]ore than almost any other single factor, domestic breeding has been used an argument for the reality of evolution." L. Eiseley*, The Immense Journey 223 (1958). Eiseley* is an internationally known anthropologist. Accord, T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 97 (1977).

and then to macroevolution. The second extrapolation has been discussed above.381/ The first extrapolation entails serious problems.

First, artifical selection is not relevant to natural selection, and thus is not a persuasive argument for it, according to Wasserman* and others:

> Artificial selection is often considered as a means for testing population genetic theories (cf. Lewontin [1974], p. 250). But there remains, in my opinion, serious doubts about the role that artifical selection could or should play. Dobzhansky ([1970], p. 201) argued that
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> > Darwin used artificial selection as a model of the natural process; a mathematical theory of selection must almost necessarily be derived from experiments on artificial selection.
>
> This belief, however (and its doubtful conclusion), rests on the implicit hypothesis that artificial selection necessarily simulates some natural selection process. One could only confirm this hypothesis by studying first the natural selection process exten-

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381. Section 2[a](2)(b) supra.

sively and then examine how well artificial selection simulates it. But if one could study the natural process in the first place, then one would not need any simulation, unless the simulation process could be better controlled (and provided the controls do not change the effects of the simulation process much from those of the natural process.)382/

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382. Wasserman*, Testability of the Role of Natural Selection within Theories of Population Genetics and Evolution, 29 British Journal of Philosophy of Science 223, 235 (1978). Russell* similarly states:

> It is important to note that in all these processes there is no "selection" in the proper meaning of the word. It is unfortunate that Darwin ever introduced the term "natural selection", for it has given rise to much confusion of thought. He did so, of course, because he arrived at his theory through studying the effects of selection as practised by man in the breeding of domesticated animals and cultivated plants. Here the use of the word is entirely legitimate. But the action of man in selective breeding is not analogous to the action of "natural selection", but almost its direct opposite, as Woltereck (1931) in particular has pointed out. Man has an aim or an end in view; "natural selection" can have none. Man picks out the individuals he wishes to cross, choosing them by the characters he seeks to perpetuate or enhance. He

Just as human ability to construct bridges

> protects them and their issue by all means in his power, guarding them thus from the operation of natural selection, which would speedily eliminate many freaks; he continues his active and purposeful selection from generation to generation until he reaches, if possible, his goal. Nothing of this kind happens, or can happen, through the blind process of differential elimination and differential survival which we miscall "natural selection".

E. Russell*, The Diversity of Animals 124 (1962). Accord, T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 97 (1977)("Artificial selection, practiced by breeders of agricultural plants and domesticated animals, has commonly been used as a model of the action of natural selection. However, in Lerner's words, "Natural Selection has no purpose. . . . For any given generation, natural selection is a consequence of the differences between individuals with respect to their capacity to produce progeny. . . . Artificial selection, in contrast, is a purposful process. It has a goal that can be visualized" (1958). Natural selection can and does take place in domesticated and laboratory organisms, and in mankind, under all sorts of natural and artificial conditions. Artifical selection is man-made, however. Natural selection has no selector, it is a self-generated outcome of interactions between organisms and their environments.").

383. W. Hall*, Partner of Nature ___ (1939). Accord, Deevey*, The Reply: Letter

does not establish that bridges evolved, without engineering human ability to breed cows does not help establish that cows arose through macroevolution.

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from Birnam Wood, 61 Yale Rev. 631, 636 (1967) ("Some remarkable things have been done by crossbreeding and selection inside the species barrier, or within a larger circle of closely related species, such as the wheats. But wheat is still wheat, and not, for instance, grapefruit; and we can no more grow wings on pigs than hens can make cylindrical eggs."); L. Eiseley*, The Immense Journey 223 (1958) ("It would appear that careful domestic breeding, whatever it may do to improve the quality of race horses or cabbages, is not actually in itself the road to the endless biological deviation which is evolution."); id. at 227 ("W. L. Johansen notes that 'the variations upon which Darwin and Wallace had placed their emphasis cannot be selectively pushed beyond a certain point, that such variability does not contain the secret of "indefinite departure."'"); D. Falconer*, Introduction To Quantitative Genetics 186 (1960) ("The improvements that have been made by selection in these [domesticated breeds] have clearly been accompanied by a reduction of fitness for life under natural conditions, and only the fact that domesticated animals and plants do not live under natural conditions has allowed these improvements to be made."). Falconer* was formerly chairman of the department of genetics at University of Edinburgh.

Second, artifical selection supports not the possibility of macroevolution but the genetic limits on viable microevolution, which were noted by Luther Burbank, the most famous breeder of this century:

> I know from my experience that I can develop a plum half an inch long or one 2-1/2 inches long with every possible length in between, but I am willing to admit that it is hopeless to try to get a plum the size of a small pea, or one as big as a grapefruit. . . . In short, there are limits to the development possible, and these limits follow a law. . . . [It is the law] of the reversion to the Average. . . . Experiments carried on extensively have given us scientific proof of what we had already guessed by observation; namely, that plants and animals all tend to revert, in successive generations, toward a given mean or average. . . . In short, there is undoubtedly a pull toward the mean which keeps all living things within some more or less fixed limitations.383/

Thus, the artificial selection argument for macroevolution is weak and irrelevant. This is a material factual issue about the noncompelling nature of evolution and the

scientific nature of creation-science.

Summary. Thus, the various alleged evidences for macroevolution are noncompelling. These are material factual issues.

(d) Alleged Stages of Macroevolution. Macroevolution, which has been defined as "[e]volutionary change above the species level"386/ and as including the "process by which all organisms have arisen by descent from a common ancestor,"387/ includes several stages. These macroevolutionary stages are summarized by biologist Thompson* of University of Missouri as follows:

> [A]ll living forms in the world have arisen from a single source that came

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386. S. Luria*, S. Gould* & S. Singer*, A View of Life 773 (1981). Accord, Mayr*, Prologue, in The Evolutionary Synthesis 1, 36 (E. Mayr* & W. Provine* eds. 1980); note 195 supra.

387. S. Luria*, S. Gould* & S. Singer*, A View of Life 767 (1981). Accord, F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 1 (1979); notes 191-93 supra.

> from an inorganic beginning. So, according to the model of evolution, [i] the first living cell [ii] "evolved" into complex multicellular forms of life; [iii] these "evolved" into animals with backbones. Fish [iv] evolved into amphibia, amphibia [v] into reptiles, reptiles [vi-vii] into birds and mammals, early mammals [viii] into primates, and primates [ix] into man. 388/

The following paragraphs divide the stages of macroevolution as follows: (i) from prokaryotes to eukaryotes, (ii) to invertebrate animals, (iii) to fish, (iv) to amphibians, (v) to reptiles, (vi) to birds and (vii) to mammals, (viii) to primates, and (ix) to man, as well as (x) to higher plants. However, the evidence for the proposed stages

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388. Thompson*, Biology, Zoology, and Genetics 1 (1983). Accord, Dobzhansky*, Evolution, 10 Encyclopedia Americana 734, 748 (1982) ("from primordial life, [i] through unicellular and multicellular organisms, [ii-iii] invertebrates and [iv-viii] vertebrate animals, [ix] to man"); G. Stebbins*, Darwin to DNA, Molecules to Humanity 174 (1982) ("Part Two: The Course of Evolution: from Molecules to Primates"); Science: Molecules to Man (4th ed. 1982).

is not this clear:

> The particular truth is simply that we have no reliable evidence as to the evolutionary sequence one can find qualified, professional arguments for any group being the descendant of almost any other.389/

The scientific evidence actually supports biological creation at least as well as biological evolution at each stage, as discussed above.390/

(i) To Eukaryotes and Problems. Macroevolution from prokaryotes to eukaryotes

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389. Bonner*, Book Review, 49 American Scientist 240 (1961); G. Kerkut*, Implications of Evolution (1961); P. Grassé*, Evolution of Living Organisms 31 (trans. 1977) ("From the almost total absence of fossil evidence relative to the origin of the phyla, it follows that any explanation of the mechanism in the creative evolution of the fundamental structural plans is heavily burdened with hypotheses. This should appear as an epigraph to every book on evolution. The lack of direct evidence leads to the formulation of pure conjecture as to the genesis of the phyla; we do not even have a basis to determine the extent to which these opinions are correct.").

390. Section 2[a](1)(a) supra.

involves a transformation from generally single-celled organisms "that lack a nucleus" (prokaryotes) to single-celled organisms "that have a distinct nucleus containing chromosomes" (unicellular eukaryotes).391/ The evolutionist symbiotic theory proposes that prokaryotic bacteria were eaten by or invaded an amoebalike cell, and the bacteria evolved into mitochondria while a nuclear membrane evolved in the host cell.392/

The problems with this major step from prokaryotes to eukaryotes have been discussed in detail by Lloyd*:

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391. F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 437, 441 (1979). Accord, S. Luria*, S. Gould* & S. Singer*, A View of Life 767, 779 (1981).

392. E.g., Sagan*, _____ 14 J. Theoretical Biology 225 (1967); Carr* & Craig*, _____, in Phytochemical Phylogeny ____, 119 (J. Harborneed 1970).

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The differences between prokaryotes and eukaryotes in messenger RNA formation "are so profound as to suggest that sequential prokaryotic to eukaryotic cell evolution seems unlikely."394/ The mitochondria DNA is not

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393. D. Lloyd*, The Mitochondria of Microorganisms 476 (1974). Accord, A. Clark*, The New Evolution 235-36 (1930)("It is almost invariably assumed that animals with bodies composed of a single cell represent the primitive animals from which all others are derived. They are commonly supposed to have preceded all other animal types in their appearance. There is not the slightest basis for this assumption beyond the circumstance that in arithmetic--which is not zoology--the number one precedes the other numbers.").

394. Darnell* states:

> The differences in the biochemistry of messenger RNA formation in eukaryotes compared to prokaryotes are so profound as to suggest that sequential prokaryotic to eukaryotic cell evolution seems unlikely. The recently discovered noncontiguous sequences in eukaryotic DNA that encode messenger RNA may reflect an ancient, rather than a new, distri-

capable of bringing about the reproduction of the mitochondria, yet self-reproduction would have been necessary for bacteria that could evolve into mitochondria.395/ The transition from prokaryotic algae to eukaryotic algae is "so fraught with confusion and contradiction that most modern biologists have ignored it."396/

(ii) To Invertebrates and Problems. Macroevolution from eukaryotes to inverte-

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bution of information in DNA and that eukaryotes evolved independently of prokaryotes.

Darnell*, Implications of RNA-RNA Splicing in Evolution of Eukaryotic Cells, 202 Science 1257, 1257 (1978).

395. D. Roodyn* & D. Wilkie*, The Biogenesis of Mitochondria (1968).

396. Margulis* states in full:

Morphologically and physiologically, trends from asexual blue green algae [prokaryotes] to sexual eukaryotic algae cannot be found. The more they have been sought, the more firmly has the discontinuity between the two forms been established. At the same time the assumption of a classical phytoflagelate has led to a literature on the classification and possible evolution-

brate animals397/ is not supported by fossil evidence, as is acknowledged by Dobzhansky*, Ayala*, Stebbins*, and Valentine*:

> The first problem does not arise with respect to animals, since the gap between Protista and the animal kingdom, which according to the present treatment is synonymous with the Metazoa, is so great that the origin of Metazoa is still obscure (Wells, 1968)
>
> . . ..
>
> Although there is a good fossil record of the major groups that have well-mineralized skeletons, the origins and earliest evolution of the metazoan phyla cannot be documented from fossil

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ary relationships between the blue green algae and the lower eukaryotes so fraught with confusion and contradiction that most modern biologists have ignored it.

L. Margulis*, Origin of Eukaryotic Cells 25, 27, 28, 34 (1970). In fact, some scientists have suggested that eukaryotes evolved into prokaryotes, rather than the reverse. E.g., Reanney*, _____, 48 J. Theoretical Biology 243 (1974); Schatz*, _____, in Membranes of Mitochondria and Chloroplasts _____, 251 (E. Racker* ed. 1970).

397. "Invertebrates" are animals without backbones. "Metazoa" are "animals that share a common multicellular ancestry with coelenterates and flatworms." T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 397 (1977).

evidence.398/ This cannot be explained as the result of an inadequate fossil record, because the fossil record is quite good.399/

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398. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 373, 397 (1977)(still contending that it is possible to produce models of metazoan origin and diversification). Paleobotanist Axelrod* of University of Californa also noted the lack of fossil ancestors:

> One of the major unsolved problems of geology and evolution is the occurrence of diversified, multicellular marine invertebrates in Lower Cambrian rocks on all the continents and their absence in rocks of greater age. . . . However, when we turn to examine the Pre-Cambrian rocks for the forerunners of these Early Cambrian fossils, they are nowhere to be found.

Axelrod*, Early Cambrian Marine Fauna, 128 Science ____, 7 (1958). Although much research has occurred since that was written, Pre-cambrian metazoa fossils still are rare if not nonexistent. Cowle*, Life in Pre-Cambrian and Early Cambrian Times, in The Fossil Record 17, 29 (W. Harland et al. eds. 1967); see Cloud*, Gustafson* & Watson*, The Works of Living Social Insects as Pseudofossils and the Age of the Oldest Known Metozoa, 210 Science ____ (1980); Schopf*, Are the Oldest "Fossils", Fossils?, 7 Origins of Life 19, 19, 21 (1976) (Spheroids). The boundary between the Cambrian and Precambrian is not clearly defined and not agreed on. Simon* In with the Older, 123 Science News 300, ____(1983).

This abrupt appearance involved not just a few organisms but representatives of nine phyla and a multitude of species, so the "seas were swarming with highly differentiated aquatic plants and animals."400/ Insects similarly appear abruptly, and the fossil "evidence for step-by-step changes leading to major evolutionary transitions looks extremely thin."401/

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399. S. Stanley*, Macroevolution 88 (1979) ("Human evolution now seems to be largely immune to the "poor fossil record" argument of phyletic gradualism. This argument also largely disappears for well-fossilized invertebrate animals, in general, when we consider that these creatures, unlike the vertebrates, have records that for major segments of geologic time are widely distributed in space and are also well studied.").

400. Barghoorn*, The Oldest Fossils, Scientific American, May 1971, at 30, 41 ("Paleozoic seas were swarming with highly differentiated aquatic plants and animals, evolved from primitive forebears that had managed to cross all three Precambrian thresholds. Half a billion years does not seem to be evolutionary "room" enough to account for such epic progress.").

401. F. Hoyle*, The Intelligent Uni-

(iii) To Fish and Problems. Macroevolution from invertebrates to chordate and vertebrate fish is also not supported by fossil evidence, according to Ommaney*, an international expert on fish:

> How this earliest chordate stock evolved, what stages of development it went through to eventually give rise

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verse: A New View of Creation and Evolution 43 (1983) ("Over ten thousand fossil species of insect have been identified, over thirty thousand species of spiders, and similar numbers for many sea-living creatures. Yet so far the evidence for step-by-step changes leading to major evolutionary transitions looks extremely thin. The supposed transition from wingless to winged insects still has to be found, as has the transition between the two main types of winged insects, the paleoptera (mayflies, dragonflies) and the neoptera (ordinary flies, beetles, ants, bees."); F. Hoyle & N. Wickramasinghe, Evolution from Space 86, 89 (1981) ("It is particulary remarkable that no forms with the wings at an intermediate stage of development have been found. Where fossil insects have wings at all they are fully functional to serve the purposes of flight, and often enough in ancient fossils the wings are essentially identical to what can be found today. Nor are there intermediate forms between the two kinds of wings. . . .").

> to truly fishlike creatures, we do not know.403/

Scientists are "mainly ignorant" of this alleged transformation despite "numerous" fossils, as noted by paleontologist Romer* of Harvard:

> In sediments of late Silurian and early Devonian age, numerous fishlike vertebrates of varied types are present, and it is obvious that a long evolutionary history had taken place before that time. But of that history we are mainly ignorant.404/

Each group of fish has its origins "firmly

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403. F. Ommaney*, The Fishes 60 (1964). Accord, J. Norman*, A History of Fishes 296 (rev. ed. 1963) ("The geological record has so far provided no evidence as to the origin of fishes . . ..").

404. A. Romer*, Vertebrate Paleontology 15 (3d ed. 1966). Accord, G. Todd*, 20 American Zoology 757 (1980)("All three subdivisions of the bony fishes first appear in the fossil record at approximately the same time. They are already widely divergent morphologically and they are heavily armored. How did they originate? What allowed them to diverge so widely? How did they all come to have heavy armor? And why is there no trace of earlier, intermediate forms?").

based in nothing," in the words of paleontologist White*, former president of the Linnaean Society and an authority on lungfish:

> Whatever ideas authorities may have on the subject, the lungfishes, like every other major group of fishes that I know have their origins firmly based in no-nothing.405/

Instead, vertebrate fish appear in the Upper Cambrian,406/ as part of the abrupt appearance of complex life in the "Cambrian explosion."407/

(iv) To Amphibians and Problems. Macroevolution from fish to amphibians again involves "phantoms" and "will-o'-the-wisps" rather than plausible fossil evidence, according to paleontologist Patterson* of the British Museum:

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405. White*, Presidential Address, 177 Proc. of Linnaean Society ___, 8 (1966).

406. Repetski*, A Fish from the Upper Cambrian of North America, 200 Science 529, 529 (1978).

407. Section 2[a](1)(a) supra.

> To me one of the most astonishing consequences of the furor over cladistics is the realization that the current account of tetrapod evolution, shown in a thousand diagrams and everywhere acknowledged as the centerpiece of historical biology, is a will-o'-the-wisp. For nowhere can one find a clear statement of how and why the recent groups are interrelated, and the textbook stories are replete with phantoms --extinct, uncharacterizable groups giving rise one to another.408/

"The transition between the Paleozoic amphibians and the 'modernized' forms is almost completely a blank: as well, as Romer* observes.409/ Ichtyostega does not constitute a transitional fossil--with it and other fossils "the deficiencies are obvious."410/

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408. Patterson*, Book Review, 29 Systematic Zoology 216, 217 (1980).

409. Romer*, Book Review, 162 Science 250 (1968).

410. Patterson* discusses Ichthyostega:

> In the second part of his paper, Gingerich discusses the stratophenetic method in relation to the origins of the major groups of tetrapods. Here I thought the deficiencies are obvious. To take one example, Gingerich asserts that discovery of Ichtyostega "provid-

(v) To Reptiles and Problems. Macro-evolution from amphibians to reptiles faces similar problems:

> There is no direct proof from the fossil record, but we can readily hypothesize the conditions under which it came about.411/

> ed an important confirmatory link" between Devonian rhipidistian fishes and Carboniferous amphibians. In support of this, he cites two reputedly rhipidistian features of Ichthyostega, neither of which is characteristic of rhipidistians alone amongst fishes, and he neglects to mention that, among the little that is known of Ichthyosteca, the skull roof, nares, and humerus have all failed to meet the expectation of smooth transition from rhipidistians to amphibians. According to Gingerich, tests of stratophenetic phylogenies are provided by new fossils. But when a new fossil is found and is inconsistent with the phylogeny (like Ichthyostega), the stratophenetic ist's answer is that this test has shown that the fossil record was insufficiently dense and continuous for the method to work. And when a new fossil is consistent with the phylogeny, the record was sufficiently dense and continuous.

Patterson*, Book Review, 29 Systematic Zoology 216, 216 (1980).

411. R. Stirton*, Time, Life and Man 416 (1957).

The most significant alleged intermediate between amphibians and reptiles does not qualify, because it is considered to be vastly more recent than the first reptiles, in Kerkut's words:

> Seymouria is sometimes thought of as a link between the Amphibia and reptiles. Unfortunately Seymouria is found in the Permian whilst the first reptiles arose in the Pennsylvanian, some 20 or so million years earlier.412/

(vi) To Birds and Problems. Macroevolution from reptiles to birds is not supported by fossil evidence, as Swinton* (an international expert) states:

> The origin of birds is largely a matter of deduction. There is no fossil evidence of the stages through which the remarkable change from reptile to bird was achieved.413/

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412. G. Kerkut*, Implications of Evolution 136 (1960).

413. Swinton*, Biology and Comparative Physiology of Birds I (A. J. Marshall*, ed. 1960). Russell* similaly concluded:

> Nothing is known with certainty as to how birds arose from reptiles or from what reptilian stock. . . .

Although pro-avis and Archaeopteryx have been frequently discussed as possible intermediate forms, neither qualifies. Pro-avis is "purely hypothetical" in the words of Ostrom* of Yale:

> No fossil evidence exists of any pro-avis. It is a purely hypothetical pre-bird, but one that must have existed--whether or not it resembled the creature shown here.414/

Archaeopteryx fossils "do not count" according to Gould* and Eldredge*,415/ and "stands

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> . . . .
>
> As we have said above, there are no palaeontological data indicating how the transformation of reptile into bird came about; we do not know whether it happened gradually or by abrupt stages. . . .

E. Russell*, The Diversity of Animals 118, 120 (1962).

414. Ostrom*, Bird Flight: How Did It Begin?, 67 American Scientist 46, 47, 50 (1979). Accord, E. Russell*, The Diversity of Animals 120 (1962) ("The Proavian forms imagined by Heilmann* (Fig. 43 above) and Boker (1935, Fig. 105) are purely hypothetical constructs and may never have existed.").

415. Gould* & Eldredge*, Punctuated equilibria: the tempo and mode of evolution reconsidered, 3 Paleobiology 115, 147 (1977)

in splendid isolation" from reptiles and birds according to Romer*,416/ as Hoyle observes:

> There are no steps in the record from reptiles to Archaeopteryx or from Archaeopteryx to birds, as the Darwinian theory requires. Indeed the situation is the opposite of what the theory predicts.417/

It was merely an unusual extinct bird, in the estimation of Russell* and others:

("At the higher level of evolutionary transition between basic morphological designs, gradualism has always been in trouble, though it remains the "official" position of most Western evolutionists. Smooth intermediates between Bauplane are almost impossible to construct, even in thought experiments; there is certainly no evidence for them in the fossil record (curious mosaics like Archaeopteryx do not count.").

416. A. Romer*, Notes and Comments on Vertebrate Paleontology ____ (1968) ("Archaeopteryx--This Jurassic bird still stands in splendid isolation; we know no more of its presumed thecodont ancestry nor of its relation to later "proper" birds than before.").

417. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 43 (1983).

> Nothing is known with certainty as to how birds arose from reptiles or from what reptilian stock. The famous fossil forms Archaeopteryx and Archaeornis of the upper Jurassic are already birds, with well developed wing and tail feathers, and the power of flight. They are, it is true, more reptilian in character than modern birds . . . . No intermediate forms between these two primitive birds and their reptilian ancestors have so far been discovered, and reconstructions, such as that proposed by Heilmann (1926) of the "Proavis", are necessarily theoretical.418/

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418. E. Russell*, The Diversity of Animals 118 (1962). Accord, Schindewolf*, Grundfragen der Palaontologie (1950). Archaeopteryx could fly or at least glide, as Feduccia* and Tordoff* conclude:

> It has been suggested that Archaeopteryx was strictly terrestrial and could not fly and that its wing feathers were therefore used, perhaps, as insect traps (2). We now present evidence that the primary feathers on the manus of Archaeopteryx, like those of modern flying birds, show an asymmetry that can be associated with an aerodynamic function. Archaeopteryx was therefore at least able to glide.

Accord, Olson* & Feduccia*, Flight Capability and the Pectoral Girdle of Archaeopteryx 278 Nature 247, 248 (1979). The significance of assymetrical features is that they indicate the capability of flying; non-flying birds such as the ostrich and emu have symmetrical feathers.

The features of Archaeopteryx that are alleged to be reptile-like can be found in various modern birds or other extinct birds.419/ Finally, a fairly modern bird has been found in the same time period (Late Jurassic), which effectively would rule Archaeopteryx out as an intermediate form between reptiles and birds.420/ The fossil evidence

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419. Teeth are the feature of Archaeopteryx that are most often cited to support the conclusion that it was not a true bird. However, other extinct ancient birds had teeth, and every other subclass of vertebrates contains some organisms with teeth and some without (amphibians, reptiles, extinct birds, mammals, etc.).

420. This discovery is described as follows:

> Although Archaeopteryx is generally considered the earliest bird on record, a recent find suggests that the creature, which lived some 130 million years ago, may not have been the only bird alive then. A new fossil found by James Jensen, of Brigham Young University dates back to the same period--the Late Jurassic--and appears to be the femur (thighbone) of a bird. If this proves to be the case, then a reexamination of the postulated role of Archaeopteryx as the evolutionary link between reptiles and birds may be in

for a reptile-bird transition is weak enough that "virtually every major group of reptiles has been proposed to be closely

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order.

. . . .

Jensen thinks that he may have found such confirmatory evidence in the form of another, more complete fossil femur excavated just a few feet away from the one in question. According to the Brigham Young investigator, this second femur is very similar to that of modern birds. Ostrom has not yet examined this latest find, however. Until he does, the situation will remain very much up in the air.

Mary*, The Oldest Fossil Bird: A Rival for Archaeopteryx?, 199 Science 284, 284 (1978). Professor Ostrom* did examine the discovery, and stated that "[i]t is obvious we must now look for the ancestors of flying birds in a period of time much earlier than that in which Archaeopteryx lived." Bone Bonanza: Early Bird, 112 Science News 198 (1977). Ostrom* also stated that "[i]t is highly improbable that Archaeopteryx is actually on the main line" to modern birds. Address by John Ostrom* at Iona College (Nov. 5, 1983). Accord, Cracraft*, Phylogenetic Relationships and Monophyly of Loons, Grebes, and Hesperornithiform Birds . . ., 31 Systematic Zoology 35, 53 (1982)("[T]he age of origin of some modern groups of birds is very old, in the Early Cretaceous if not before. This places them very nearly as old as Archaeopteryx and raises the possibility

related, if not ancestral, to birds."421/

(vii) To Mammals and Problems. Macroevolution from reptiles to lower mammals is not strongly supported by the fossil record. This dramatic transition is described as "puzzling" by Simpson*:

> The most puzzling event in the history of life on earth is the change from the Mesozoic, Age of Reptiles, to the Age of Mammals. It is as if the curtain were rung down suddenly on a stage where all the leading roles were taken by reptiles, especially dinosaurs in great numbers and bewildering variety, and rose again immediately to reveal the same setting but an entirely new cast, a cast in which the dinosaurs do not appear at all, other reptiles are supernumeraries, and all the leading parts are played by mammals of sorts barely hinted at in the preceding acts.422/

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that Archaeopteryx is not the temporal benchmark of avian evolution we so often assume.").

421. Martin*, Stewart* & Whetstone*, The Origin of Birds: Structure of the Tarsus and Teeth 97 The Auk 86-93 (Jan. 1980). Accord, Benton*, No Consensus on Archaeopteryx, Nature, Sept. 8, 1983, at 99, 100.

422. G. Simpson*, Life Before Man 42 (1972).

The "mammal-like reptiles" (synapsids) are proposed as "the one example known where the evolution of one class of vertebrates from another class is well documented by the fossil record,"423/ but these extinct organisms themselves appear suddenly and disappear suddenly without further intermediate forms, in the words of Kemp*:

> Each species of mammal-like reptile that has been found appears suddenly in the fossil record and is not preceded by the species that is directly ancestral to it. It disappears some time later, equally abruptly, without leaving a directly descended species, although we usually find that it has been replaced by some new, related species.424/

These mammal-like reptiles instead are simply extinct reptiles. Although they are described as mammal-like reptiles primarily

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423. T. Kemp*, Mammal-Like Reptiles and the Origin of Mammals, 1 (1982).

424. T. Kemp*, Darwin Up To Date 33 (1982). Accord, Hopson*, Book Review, 219 Science 49, 50 (1983).

because of their jaw articulation, that is an "inadequate" basis for treating them as intermediate forms.425/

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425. Gow* discusses this:

> The presence of a squamosal-dentary articulation forming part or all of the joint between the skull and lower jaw is not used as the most practical diagnostic criterion for the class Mammalia (1).
>
> This distinction in the jaw articulation was found to be inadequate, however. At least some cynodents, such as ictidosaurs (2) and Probainognathus (3), have a dentary-squamosal contact, which makes them mammals by strict application of this criterion. Yet their complex lower jaws and single auditory ossicle in the middle ear are clearly still reptilian. Opinion has long been divided as to whether ictidosaurs are reptiles or mammals.

Gow*, An Ictidosaur Fossil from North America, _____ _____ _____ (Feb. 1983). The most-discussed possible "intermediates," Morganucodon and Kuehneotherium, both were reptiles in terms of their jaw bones:

> Like Morcanucodon, Kuehneotherium must have had a full complement of the reptilian bones in its lower jaw, and shows a facet for the coronoid bone . . . .

_____*, _____, 47 J. Linnaean Society 418, 418 (1968). The same is true of the mammal-reptile difference in the middle ear. "Those general

Macroevolution from lower mammals to higher mammals poses similar problems: the absence of transitional forms "is true of all the thirty-two orders of mammals," as summarized by Simpson*.426/ The "'missing links' have for the most part remained missing," in the words of Russell*:

> The absence or extreme scarcity of forms transitional between a presumed, or a known, ancestral form and its later derivatives is a well known peculiarity of the geological record. "Missing links" have for the most part remained missing. Even in the Mammals, whose geological history is comparatively well documented, serious gaps in the record occur just at the time when the primary differentiation of the Orders is taking place. As Simpson points out, "The earliest and most

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statements about the evolution of the mammalian middle ear that appear are in the nature of proclamations. No methods are described which allow the reader to arrive with Fleisher at his "ancestral" middle ear, nor is the basis for the transformation series illustrated for the middle ear bones explained." R. Lombard*, Evolution 1230 (1979).

426. G. Simpson*, Tempo and Mode in Evolution 105 (1944).

> primitive members of every order already have the basic ordinal characters, and in no case is an approximately continuous series from one order to another known. In most cases the break is so sharp and the gap so large that the origin of the order is speculative and much disputed . . .. The Bats, we must assume, have evolved, like other mammalian Orders, from the primitive insectivores of Upper Cretaceous and Paleocene times, but of this great transformation, involving an entirely new mode of life, and a high degree of structural specialisation, we have so far no record. So also with the Whales , as we have already seen. Though in this case primitive forms are known, these are not ancestral to the modern whales, which are not linked to the primitive mamallian stock by any known intermediate forms.427/

The horse series, which is portrayed in many public school texts, has "had to be discarded or modified" according to Raup*, 428/ and is described as follows by Seiff*

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427. E. Russell*, The Diversity of Animals 130 (1962).

428. Raup* states:

> The record of evolution is still surprisingly jerky and, ironically, we have even fewer examples of evolutionary transition than we had in Darwin's time. By this I mean that some of the

and Macbeth*:

> At the beginning of this memorandum we mentioned the belief common among nonscientists that the evolutionists had discovered innumerable phylogenies. If we are correct in saying that the search has failed miserably, the reader will ask where this common belief comes from. The answer is that to a large extent it comes from a very deceptive picture that has been presented over and over again in the literature. This is the famous chart that shows, in seven neatly graded steps, the supposed descent of the horses from tiny Eohippus to the modern Equus. This chart is so persuasive that most readers will be shocked to learn that it is an illusion.
>
> These seven stages do not represent ancestors and descendants. They are fossils that were taken from different times and places, and were then strung together, perhaps innocently,

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> classic cases of Darwinian change in the fossil record, such as the evolution of the horse in North America, have had to be discarded or modified as a result of more detailed information--what appeared to be a nice simple progression when relatively few data were available now appears to be much more complex and much less gradualistic.

Raup*, Conflicts between Darwin and Paleontology, Field Museum of Natural History Bull., Jan. 1979, at 22, 25.

> to show how evolution might have (or should have) handled the matter. The experts, good Darwinians though they may be, do not contend that things actually occurred in this simple straightforward way. They regret that the chart was ever made and they have tried to expunge it from the record, but it persists despite their efforts and appears in one textbook after another (including Dunbar's of 1949 and Grant's of 1977).429/

It is "unfortunate" in the view of Hardin*, and is not a legitimate case of "slow and steady transformation" in the opinion of Gould*.430/ Its problems are numerous: the

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429. E. Seiff* & N. Macbeth, Evolution (unpublished ms. 1982).

430. Hardin* writes:

> [T]here was a time when the existing fossils of the horses seemed to indicate a straight-line evolution from small to large, from dog-like to horse-like, from animals with simple grinding teeth to animals with the complicated cusps of the modern horse. It looked straight-line--like the links of a chain. But not for long. As more fossils were uncovered, the chain splayed out into the usual phylogenetic net, and it was all too apparent that evolution had not been in a straight line at all, but that (to consider size only) horses had now

small Eohippus was probably not a horse; the series depends on an unsupported assumption of genealogical relation between the fossils; the sequence depends on arbitrary matching of European and American fossils; and the range in size is no greater than for modern horses.431/

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grown taller, now shorter, with the passage of time. Unfortunately, before the picture was completely clear, an exhibit of horses as an example of orthogenesis had been set up at the American Museum of Natural History, photographed, and much reproduced in elementary textbooks (where it is still being reprinted today).

G. Hardin*, Nature and Man's Fate 225-26 (1961). Gould's* full comment is:

Paleontologists have documented virtually no cases of slow and steady transformation, foot by foot up the strata of a hillslope--not for horses, not for humans.

Gould*, Evolution: Explosion, Not Ascent New York Times, Jan 22, 1978, at ___.

431. Kerkut* writes:

We now know that the evolution of the horse did not always take a simple path. In the first place it is not clear that Hyracotherium was the ancestral horse. Thus Simpson (1945) states, "Matthew has shown and insist-

(viii) To Primates and Problems. Mac-

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ed that Hyracotherium (including Eohippus) is so primitive that it is not much more definitely equid than tapirid, rhinocerotid, etc., but it is customary to place it at the root of the equid group."

Similarly it is clear that though in general the horses did increase in size, certain genera such as Orohippus, Archaeohippus and Nannippus appear to have been smaller than their ancestors. Edinger (1948) from her studies of the casts of the skull and the brains of fossil horses has concluded that the brain surface of the early fossil horses was perfectly smooth and that the sulci have developed at a later date. This would indicate that any resemblances that have been drawn between the sulci on the brain of the modern horse and those of other mammals are either due to convergent evolution or to homology.

It is quite likely that further studies will show that the complexity of horse evolution will prove to be as great as that found in the Proboscidea, Rhinocerotidea or Camelidae.

G. Kerkut*, Implications of Evolution 149 (1960); F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 41 (1983) ("The evidence that was advanced to support the theory, for example fossil sequences of horses of increasing stature, was of little relevance since it concerned animals possessing basically the same genetic structure. Besides which, such se-

roevolution from lower mammals to primates is postulated to have come through insectivores, but is "not documented by fossils," according to Kelso*:

> While the fossil record of insectivore evolution is reasonably good in some lines, the transition from insectivore to primate is not documented by fossils. The basis of knowledge about the transition is by inference from living forms.434/

"In spite of recent findings, the time and

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quences could have involved external factors--nutrition for example."; F. Hitching*, The Neck of the Giraffe: Where Darwin Went Wrong 28-31 (1982).

434. A. Kelso*, Physical Anthropology: An Introduction 142 (2d ed. 1974). This is true of both new world monkeys and old world monkeys:

> The details of the evolutionary background of the New World monkeys, the Platyrrhinae, would doubtless be informative and interesting, but unfortunately we know very little about them.
>
> . . . .
>
> Clearly, the fossil documentation of the emergency of the Old World monkeys could provide key insights into the general evolutionary picture of the primates, but, in fact, this record simply does not exist.

Id. at 150-51.

place of origin of order Primates remains shrouded in mystery."435/

(ix) To Man and Problems. Macroevolution from primates to man is described as follows in a typical textbook used in Louisiana public schools: "Man shares a common ancestor with the apes."436/ Yet this macroevolutionary step is not supported by "any fossil traces," according to Zuckerman*:

> But in the final analysis, the answer to the question of human descent always depends upon preconceptions about the way this evolution occurred. For example, no scientist could logically dispute the proposition that man, without having been involved in any act of

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435. Simons*, The Origin and Radiation of the Primate, 167 Annals of N. Y. Academy of Sciences 318 (1969). Tree shrews also do not provide the link. Campbell*, Taxonomic Status of Tree Shrews, 153 Science 436 (July 22, 1966) ("I have attempted to indicate the large number of recent studies whose results indicate that a close relationship between tupaiids and primates is unlikely.")

436. Biological Science Curriculum Study*, Biological Science: Molecules to Man 383 (3d ed. 1973 & 1976).

> divine creation, evolved from some ape-like creature in a very short space of time--speaking in geological terms--logical terms--without leaving any fossil, traces of the steps of the transformation.437/

The problem is not an inadequate fossil record: "Human evolution now seems to be largely immune to the 'poor fossil record' argument of phyletic gradualism.438/ The

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437. Zuckerman*, Beyond the Ivory Tower 64 (1970). Accord, Gribben* & Cherfas*, Descent of Man--Or Ascent of Apes?, 91 New Scientist 592-95 (Sept. 3, 1981) ("the frailty of the conventional history of man and the apes."); Gould*, Evolution: Explosion, Not Ascent, New York Times, Jan. 22, 1978, at _____ ("Paleontologists have documented virtually no cases of slow and steady transformation, foot by foot up the strata of a hillslope--not for horses, not for humans."); R. Leakey*, The Making of Mankind 43 (1981) ("Science is often seen as a search for answers that, given sufficient time, must surely be forthcoming, but because of the nature of the evidence--or rather, lack of it--this may not be the case in paleoanthropology. David Pilbeam concludes, "It's my conviction that there may be many aspects of human evolution that will always elude us. We should be straightforward and honest about that.").

438. S. Stanley*, Macroevolution 88 (1979).

problem is compounded by misleading pictures, which are merely artists' imaginative portrayals:

> These reconstructions suggest far more knowledge of human evolution than we actually possess. We do not have a complete skeleton of any fossil older than Neanderthal, nor do we have any direct evidence about the extent of hair in these forms.439/

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439. B. Campbell*, Humankind Emerging 34 (3d ed. 1982) (although believing that the drawings give a correct sequence and some idea of ancestors' nature). Accord, Oxnard*, Human Fossils: New Views of Old Bones, 41 American Biology Teacher 264, 264 (1979) ("the completely different portraits that have been drawn for the facial features of a creature such as Zinjanthropus"); Rensberger, Facing the Past, Science 81, Oct. 1981, at 41, ___.

Artists have also been rehabilitating Homo erectus, a hominid that lived between Australopithecus and Neanderthal, even without much change in the scientific opinion of this older species' appearance. Again, Burian is a case in point. His 1952 version shows black, apelike creatures barely distinguishable from chimpanzees. In a 1965 painting his Homo erectus is lighter skinned and, although still hairy, more modern in aspect. Burian's 1975 Homo erectus is hairless and almost indistinguishable from people living today.

[G-333 IS INTENTIONALLY OMITTED]

And the problem is further magnified by such frauds and gross misinterpretations as Piltdown Man (Eonthropus dawsoni), which was fraudulently fabricated from a filed down ape jaw and fossil teeth, Nebraska Man (Hesperopithecus haroldcookii), and a recent "hominid collarbone":

> Nor can it be maintained, as some Darwinists have done, that the exposure of Piltdown man leaves them no better and no worse off than they were before. It does, in fact, weaken their position in regard to both their theory and their methods. The zeal with which eminent scientists defended it, the facility with which even those who did not welcome it managed to accommodate to it, and the way in which the most respected scientific techniques were soberly and painstakingly applied to it, with the apparent result of con-

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> The newest images of Homo erectus show them as far more modern than all but most recent depictions of their Neanderthal descendants.
>
> Once again, in the view of many paleoanthropologists, the story of human evolution has been fictionalized to suit needs other than scientific rigor.

Id. at ____.

firming both the genuineness of the fossils and the truth of evolution, are at the very least suspicious.440/

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440. G. Himmelfarb*, Darwin and the Darwinian Revolution, 310-11 (1959). Accord, Oxnard*, Human Fossils: New Views of Old Bones, 41 American Biology Teacher 264, 264 (1979) ("But we have merely to remember cases like Piltdown Man, which turned out to be a fraudulent composite of a genuine fossil skull cap, and a modern ape jaw, or Hesperopithecus, the ape of the West, which eventually was discovered to be a peccary [pig], or even of the completely different portraits that have been drawn for the facial features of a creature such as Zinjanthropus (Campbell 1964), to realize that this method also has many inherent difficulties."); Straus*, The Great Piltdown Hoax, 119 Science 265, 265 (1954); Anderson*, Hominid collarbone exposed as dolphin's rib, 98 New Scientist 199 (April 28, 1983) ("He puts the incident on a par with two other embarassing faux pas by fossil hunters: Hesperopithecus, the fossil pig's tooth that was cited as evidence of very early man in North America, and Eoanthropus or "Piltdown Man," the jaw of an orangutan and the skull of a modern human that were claimed to be the "earliest Englishman".). Anthropologist White* of Berkely observes:

> The problem with a lot of anthropologists is that they want so much to find a hominid that any scrap of bone becomes a hominid bone.

Id. Accord, Zuckerman*, Beyond the Ivory Tower 64 (1970) (based on site of brain case and pelvic bones) he states:

> The [fossil] record is so astonishing

The missing "fossil traces" are not provided by the fossil remains of Australopithecines (including Australopithecus, Homo habilis, and Zinlanthropus) and Ramapithecus (which were simply extinct apes), or by Neanderthaloids and Cro-Magnon man (which were simply ancient men). Australopithecines were simply apes, according to Zuckerman*.441/

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that it is legitimate to ask whether much science is yet to be found in this field at all. The study of the Piltdown Man provides a pretty good answer. S. Zuckerman*, Beyond the Ivory Tower 64 (1970).

441. Zuckerman*, Beyond the Ivory Tower 77,81, 85, 91 (1970).

For my own part, the anatomical basis for the claim that the Australopithecines walked and ran upright like man is so much more flimsy than the evidence which point to the conclusion that their gait was some variant of what one sees in subhuman Primates, that it remains unacceptable.

. . ..

Where I went wrong was in supposing that, in the field of anatomy I am talking about, facts such as we have been collecting could stem a tide of opinion based on ex cathedra statement. We were not the first to make this

They are not intermediate forms between apelike ancestors and man, in the view of Oxnard*:

> mistake. Professor Waterson made a similar error, as I pointed out earlier on, with respect to the Piltdown skull, and so too have others, about other fossils. The unscientific and doctrinaire character of the whole of this field of study is well epitomised . . . ..
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> . . ..
>
> So much glamour still attaches to the theme of the missing link, and to man's relationships with the animal world, that it may always be difficult to exorcise from the comparative study of Primates, living and fossil, the kind of myths when the unaided eye is able to conjure out of a well of wishful thinking.

Id. at 93-94. See also Oxnard*, Human Fossils: New Views of Old Bones 41 American Biology Teacher 264-76 (May 1979)("[W]hereas the conventional wisdom is that the australopithecine fragments are generally rather similar to humans and when different deviate somewhat towards the condition in the African apes, the new studies point to different conclusions. The new investigations suggest that the fossil fragments are usually uniquely different from any living form: when they do have similarities with living species, they are as often as not reminiscent of the orangutan. This does not mean, of course, that the fossils are related in any genetic way to the orangutan.").

> We may well have to accept that it is rather unlikely that any of the australopithecines, including Homo habilis, can have had any direct phylogenetic link with the genus Homo.442/

In fact, Australopithecines could not be ancestors of man, because the more-modern Homo erectus lived in the same general time and place.443/ A recent fossil species,

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442. Oxnard*, _____, 258 Nature ___, ____ (1975). Accord, Oxnard*, The place of the australopithecines in human evolution: grounds for doubt?, 258 Nature 389-395 (Dec. 4, 1975) ("Although most studies emphasize the similarity of the australopithecines to modern man, and suggest, therefore, that these creatures were bipedal tool-makers at least one form of which (Australopithecus africanus--"Homo habilis", "Homo africanus") was almost directly ancestral to man, a series of multivariate statistical studies of various postcranial fragments suggests other conclusions."); Rak* & Clark*, Ear Ossicle of Australopithecus Robustus, 279 Nature 62-63 (May 3, 1979) ("We report here the discovery of the first ear ossicle, an incus, of a Plio-Pleistocene hominid. It is substantially different from that of modern man, and the dissimilarity exceeds that between the ear bones of Homo sapiens and of the African apes.").

443. Leakey*, Excavations in Beds I and II, 1960-63, 3 Olduvai Gorge, M. Leakey

"Lucy" (Australopithecus afarensis), has been proposed as a common ancestor. However, "Lucy's legs were clearly diminutive and more like those of an ape than a human," in the view of Jungers*,444/ and Lucy coexisted with a more modern species, in the analysis of Tuttle*.445/ Homo habilis has

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ed. 1971) ("Homo erectus, Homo habilis and a robust australopithecine all existed at Olduvai during Bed II times."); De Vore*, Introduction, in The Origin of Man 11 (P. DeVore* ed. 1965) (Homo erectus in same stratum as Australopithecus robustus in Swartkrans, South Africa.).

444. Lewin*, Do Ape-Size Legs Mean Ape-Like Gait?, 221 Science 537-38 (1983) ("Jungers compared the length of Lucy's femur with an African ape standard (a chimpanzee for example) computed to the same body size. There was virtually no difference between the two. . . . Lucy's legs were clearly diminutive and more like those of an ape than a human, concluded Jungers.").

445. Tuttle*, Was Lucy a Climber? Dissenting Views of Ancient Bones, 122 Science News 116 (1982) ("another more human species of ape-man co-existed with A. afarensis about 3.7 million years ago."); W. Herbert*, Lucy: The trouble with dating an older woman, Science News 5 (Jan. 1, 1983) ("A geologist and an anthropologist, working independently, have recently challenged

been assessed as merely a species of Australopithecus and thus as "improperly proposed" name, by Brace*.446/ Ramapithecus falls in the ape category too: fossils of "Ramapithecus . . . seem to have been apes --morphologically, ecologically, and behaviorally."447/ In fact, the "entire Ramapithecus, walking upright, has been 'recon-

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the age of the Hadar fossil site in Ethiopia, raising questions about the age and significance of the Hadar's most famous hominid, Lucy. Lucy's American proprietors, while welcoming the geological clarification of the shaky Hadar dates, have rejected the anthropological work wholesale, charging their critic with methodological clumsiness and intellectual dishonesty.").

446. Brace*, Humans in Time and Space, in Scientists Confront Creationism 258 (L. Godfrey* ed. 1981).

447. Eckhardt*, Population Genetics and Human Origins, 226 Scientific American 94, 101 (Jan. 1972). Accord, Walker* & Andrews*, Reconstruction of the Dental Arcades of Ramapithecus wickeri, 244 Nature 313, 314 (1973) ("It seems like that R. wickeri had very small incisors indeed and posteriorly diverging and nearly straight cheek-tooth rows, rather than widely separated and curved tooth rows such as are found in modern man.").

structed' from only jaws and teeth. In 1961, an ancestral human was badly wanted. [Ramapithecus] latched onto the position by his teeth, and has been hanging on ever since . . .."447a/ The same is probably true of Olduvai Hominid 8.448/

447a. Zihlman* & Lowenstein*, False Start of the Human Race, Natural History Aug. 1979, at 86, 89. Accord, id. at 88 ("There are still no skulls, no pelvic or limb bones unequivocally associated with the teeth to show whether Ramapithecus had a brain like a hominid, swung through the trees like an ape, or walked upright like a human.").

448. Oxnard*, Homo, 30 225, 246 (1981) ("Although most assessments of the Olduvai [8] (10) foot imply that it is from a creature bipedal in the manner of man, a series of new studies involving multivariate morphometric analyses of the talus and rearticulation of the entire suite of foot bones shows that the original designations are in error. The new studies indicate a foot not entirely like that of any particular present day ape though sharing features with them, but completely different from man. Such a finding implies that perhaps this fossil is not so closely linked with the human lineage as presently believed and this is corroborated by the results of a series of other studies, using the multivariate morphometric techniques on other anatomical regions of australpithe-

Neanderthal man and Cro-Magnon man are categorized in the same species as modern humans (Homo sapiens). One specimen of Neanderthal man appears to have been a human with a bone disease such as rickets.449/ Cro-Magnon man was essentially modern.

Apes and man differ in category rather than merely in degree. One difference is

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cines from Olduvai and Southern Africa.); Oxnard* & Lisowski*, Functional Articulation of Some Hominid Foot Bones: Implications for the Olduvai (Hominid 8) Foot 52 American Journal of Physical Anthropology 107-117 (1980) (Subsequent studies showed the conclusions on the talus to be wrong: The fossil talus, as defined by eight measures, does not resemble that of man but is reminiscent of those of creatures known (extant--orangutans) or believed (extinct--some fossil apes and monkeys) to be arboreal in habitus. . . .").

449. Ivanhoe*, Was Virchow Right about Neanderthal?, 227 Nature 577, 577 (1970) ("Nearly a hundred years ago Virchow diagnosed rickets in the Neanderthal bones, accounting for their peculiar simian cast. . . . But the growth of knowledge since, anthropological as well as medical, suggests that Virchow's view may have been essentially correct.").

in language: "almost all the psychologists and linguists who have studied the evidence closely are quite satisfied that there is a major discontinuity between human speech and the sign-making capacity of apes."450/ Another difference is in abstract thought. Another is in conscience and moral thought. The fossil record--"no fossil traces"--is corroborated by the other grounds for these "natural groupings."

Some evolutionists have ridiculed the position of creationist scientists as arguing against the straw man of "man evolving from apes." First, creationist scientists generally state the evolutionist position correctly as being that "man and apes

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450. Leach*, Men, Bishops and Apes, 293 Nature 19-21 (Sept. 3, 1981). Accord, Mistler-Lackman* & R. Lachman*, Language in Man, Monkeys and Machines, 185 Science 871 (1974); Wade*, Does Man Alone Have Language?, 208 Science ____, (1980).

evolved from a common ancestor." Second, the phrase "man evolved from apes" is not a straw man, but is precisely what many if not most evolutionists claim, as Simpson* (a leading evolutionist) acknowledges:

> On this subject, by the way, there has been too much pussyfooting. Apologists emphasize that man cannot be a descendant of any living ape--a statement that is obvious to the verge of imbecility--and go on to state or imply that man is not really descended from an ape or monkey at all, but from an earlier common ancestor. In fact, that earlier ancestor would certainly be called an ape or monkey in popular speech by anyone who saw it. Since the terms ape and monkey are defined by popular usage, man's ancestors were apes or monkeys (or successively both). It is pusillanimous if not dishonest for an informed investigator to say otherwise.450a/

Dozens of evolutionist publications make the "ape to man" argument.450b/

450a. Simpson*, The World into Which Darwin Led Us, 131 Science, Apr. 1, 1960 at 966, 969. Accord, G. Simpson*, This View of Life 12 (1964).

450b. A. Montague*, An Introduction to Physical Anthropology 102 (1951) ("Some

(x) To Plants and Problems. Macroevolution from early life to plants, and then

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authorities interpret the facts to indicate that man . . . originated either from a tarsioid or generalized catarrhine monkey. . . ."); A. Montague*, The Science of Man 14 (1964) ("it was from the Old World monkey stock that the early anthropoids arose, and from these, in turn, that the line which led to man came into being."); F. Rhodes*, The Evolution of Life 252 (1962) ("anthropoid apes lived in Europe, Asia, and Africa during Miocene times, and it is amongst these that our remote ancestors will probably be found."); W. Stokes*, Essentials of Earth History 361 (1960) ("Either he diverged from the apes at a relatively late time and is a 'made over ape' or he split off from the primates much earlier at the evolutionary stage represented by the tarsiers or lower monkeys."); L. Eisley*, The Immense Journey 111 (1957) ("The ape whose cultural remains at the beginning of the first glaciation can scarcely be distinguished from chance bits of stone has, by the end of the fourth ice age, become artist and world rover, penetrator of the five continents and master of all."); Eisley*, The Time of Man, 4 _____, March 1962, at 4 ("Once he was thought a fallen angel; then we found him to be an ascended ape."); Shapiro*, _____, in Man, Culture and Society, 5 (H. Shapiro, ed. 1956) ("his recent emergence from the world of apes."); E. Hooten*, Apes, Men, and Morons 105 (1938) ("He made himself from an ape and created human culture.");

to higher plants, is contradicted by the fossil record, as assessed by botanist

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W. Howells*, Mankind So Far 3 (1945) ("In body and brain he is simply a made-over ape, with no fundamental distinctions at all."); Washburn*, Tools and Human Evolution, 203 Scientific American, Sept. 1960 at 63 ("Man began when populations of apes . . . started the bipedal, tool-using way of life that gave rise to the man-apes of the genus Australopithecus."); Muller*, Man's Place in Living Nature 84 Scientific American, May 1957 at 250 ("It is fashionable in some circles to refer slurringly to the inference that apes were ancestral to men, . . . and that it is more proper to say that men and apes, perhaps even men, apes, and monkeys, diverged long ago from a stem form that was more primitive than any of these. This is mere wishful thinking on the part of those who resent too vivid a visualization of their lowly origin and their present-day poor relations."); Straus*, The Riddle of Man's Ancestry, 24 Quarterly Review of Biology 200, 203 (1949)("perhaps the majority of anthropologists and comparative anatomists . . . believe that man has evolved from a true anthropoid ape at a relatively late geological date."); Straus*, The Riddle of Man's Ancestry, 24 Quarterly Review of Biology 200, 202 (1949) (T.H. Huxley's* "concepts of man's relationship to the other primates today remains the orthodox one, differing only in details imposed by the advance of knowledge. . . . In its present orthodox form, this theory assumes that man evolved from an animal that would be class-

Corner* of Cambridge:

> Much evidence can be adduced in favour of the theory of evolution--from biology, bio-geography and palaeontology, but I still think that, to the unprejudiced, the fossil record of plants is in favour of special creation. If, however, another explanation could be found for this hierarchy of classification, it would be the knell of the theory of evolution. Can you imagine how an orchid, a duckweed, and a palm have come from the same ancestry, and have we any evidence for this assumption? The evolutionist must be prepared with an answer, but I think that most would break down before an inquisition.451/

Summary. These ten alleged stages of macroevolution are supported by much ardent

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ified as an anthropoid ape."); R. Dart*, Adventures with the Missing Link 215 (1959) ("As Elliot Smith put it: 'The acquisition of speech was, in fact, an essential part of the process of transforming an ape into a human being.").

451. Corner*, Evolution, in Contemporary Botanical Thought at 95, 97 (A. MacLeod* & L. Coblely* eds. 1961). The "progressive increase in the frequency and taxonomic diversity of trilete spores" may not be "a function of organic evolution" but rather "largely a function of biofacies." Gray* & Boucot*, Early Silurian Spore Tetrads from New York: Earliest New World Evidence for Vascular Plants?, 173 Science 918, 920, 921 (1971).

belief but little persuasive evidence, as many noncreationists have concluded452/ such as Kerkut* of University of Southampton:

> There is a theory which states that many living animals can be observed over the course of time to undergo changes so that new species are formed. This can be called [microevolution or] the "Special Theory of Evolution" and can be demonstrated in certain cases by experiments. On the other hand there is the theory that all the living forms in the world have arisen from a single source which itself came from an inorganic form. This theory can be called the [macroevolution of] the "General Theory of Evolution" and the evidence that supports it is not sufficiently strong to allow us to consider it as anything more than a working hypothesis. It is not clear whether the changes that bring about speciation are of the same nature as those that brought about the development of new phyla. The answer will be found by future experimental work and not by dogmatic assertions that the General Theory of Evolution must be correct because there is nothing else that will satisfactorily take its place.453/

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452. Sections 2[a](2)(a)(iv)-(vi) supra.

453. G. Kerkut*, Implications of Evolution 157 (1960).

Why does macroevolution still command support? The belief that "a bad theory is better than no theory," according to Koestler*: "they are unable or unwilling to realize that the citadel they are defending lies in ruins."454/

Macroevolution simply does not have a compelling status, and reasonable difference of opinion is possible. These alleged stages of macroevolution are material factual issues.

How critical is macroevolution to science? Paleontologist Patterson* of the British Museum says that it conveys only "antiknowledge" (as harmful to knowledge as anti-matter is to matter):

> I feel that the effects of hypotheses of common ancestry in systematics has not been merely boring, not just a lack of knowledge, I think it has been

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454. A. Koestler*, Janus: A Summing Up 192 (1978).

> positively anti-knowledge. . . . Well, what about evolution? It certainly has the function of knowledge but does it convey any? Well, we are back to the question I have been putting to people, "Is there one thing you can tell me about evolution?" The absence of answers seems to suggest that it is true, evolution does not convey any knowledge 455/

Mathews* describes another author as thinking macroevolution's "effect has been bad for biology."456/ Zoologist Boyden* of Rutgers says that Darwinism led "to the most unscientific attitudes in regard to taxonomic work," and spawned a "host of phylogenies . . . like weeds."457/ Rosen*, Forey*, Gardiner*, and Patterson* blame macroevolu-

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455. Address of Dr. Colin Patterson* at American Museum of Natural History, tr. at 3 (Nov. 5, 1981).

456. Mathews*, Introduction, to C. Darwin, The Origin of Species, i-xii (1971).

457. A. Boyden*, Perspectives in Zoology 117 (1973); Address of Dr. Colin Patterson*, American Museum of Natural History, tr. at 6 (Nov. 5, 1981) ("I want to use it to make another point about evolution being an antitheory that conveys antiknowledge. It is harmful to systematics.").

tion for a "lack of progress" in paleontology.458/

Conclusion. Biological evolution includes macroevolution as well as microevolution, and macroevolution does not have a compelling status (microevolution is not questioned by creation-science). Among approaches to macroevolution, classical Darwinian evolution has been essentially abandoned, and the non-Darwinians, transformed cladists, and anti-Darwinians as well as creationist scientists are rejecting the

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458. Rosen*, Forey* Gardiner* & Patterson*, Lungfishes, Tetrapods, Paleontology, and Plesiomorphy 167 Bull. American Museum of Natural History 163, 178 (1981). Accord, Patterson*, Significance of Fossils in Determining Evolutionary Relationships, 12 Ann. Rev. of Ecology and Systematics 195, 211 (1981) ("I cannot avoid the conclusion that before the development of the cladistic method paleontology was a hindrance rather than a help, stifling progress towards the goal of determining evolutionary relationships, and promulgating unjustifiable inferences about the pattern of evolution in the group.").

modern evolutionary synthesis (neo-Darwinism) and the punctuated equilibria approach. In terms of alleged mechanisms for macroevolution, the one clear thing that can be said is that evolutionist scientists do not agree on a mechanism and do not have a plausible mechanism. In terms of alleged evidence for macroevolution, the various lines of argument are not compelling, and indeed face much contrary evidence. In terms of alleged stages of macroevolution, the evidence is not compelling for a single segment of the alleged evolutionary tree, and the scientific evidence gives at least as much support to creation-science through the abrupt appearance of complex organisms and the systematic gaps between fossil families or genera. These are material factual issues.

(3) Difference from the McLean Case concerning Biological Creation and Biological Evolution

The above affirmative scientific evidences for biological creation show the McLean opinion to be mistaken in its conclusions that "creation-science is not science" and that the "proof in support of creation-science consisted almost entirely of efforts to discredit the theory of evolution."459/ In contrast with that opinion, biological creation does not involve creation of "kinds," but instead of families or genera; does not include creation "from nothing"; and does not involve "fixed limits of originally created kinds" with "no scientific explanation," but instead involves genetic limits on microevolution under natural laws of heredity and genetics.460/

459. McLean v. Arkansas Board of Education, 529 F. Supp. 1255, 1270, 1272 (E.D. Ark. 1982).

460. Id. at 1265, 1267-68.

Further, biological creation and creation-science generally do not essentially involve a "worldwide flood" or a "relatively recent inception" of the earth and life.461/ The "only source of this information" is not "ultimately contained in the book of Genesis"462/--which does not mention paleontology, comparative morphology, information content, probability, genetics, and comparative unrelatedness--but in science.

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461. Id. at 1265, 1278.
462. Id. at 1272.

b. Material Factual Issues about the Scientific Nature of Creation-Science and Evolution concerning the First Life

Definitions. The origin of the first life on earth is the second aspect of evolution and creation-science. Evolution includes biochemical evolution468/, and "chemical" or "biochemical evolution" are generally accepted terms.469/ Biochemical evolution describes the origin of the first life as through transformation from nonliv-

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468. Numerous examples are given at the beginning of Section 2[b])2 and n. 508 infra.

469. Note 509 infra.

NOTE: Scientists cited in this Section (b), unless otherwise indicated, are not creationists, and their quoted statements are not intended as endorsements of creation-science. However, their quoted statements are acknowledging data that creationist scientists interpret as supporting creation-science better that evolution-science.

ing matter to the first living organisms. It is presented in public school textbooks as part of evolution such as the following in a Louisiana textbook:

> Recent discoveries in science have helped biologists to see how Darwin's ideas about evolution might also apply to single-celled organisms. Just as today's complex organisms are probably modified descendants of earlier, simpler forms, so simple one-celled organisms have probably evolved from even simpler systems.470/

Biochemical creation describes the origin of life as through abrupt appearance in complex form, as indicated by empirical evidence and scientific interpretations thereof.

Summary. This empirical evidence for biochemical creation is summarized in Section (1), and the noncompelling status of biochemical evolution is outlined in Section

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470. Biological Sciences Curriculum Study*, Biological Science: Molecules to Man 110 (3d ed 1973 & 1976). Accord, note 511 infra.

(2), while the errors of the McLean decision about these explanations are outlined in Section (3) below.

(1) Empirical Evidence for Biochemical Creation (of the First Life)

Overview. Biochemical creation consists of empirical evidence and scientific interpretations along at least five affirmative lines:

(a) Information content argument, (b) Probability argument, (c) Isomer argument, (d) Chemistry argument, (e) Thermodynamics argument.

(a) The information content argument is based on the vast information content of the least complex living organism, of its genetic coding system, and of its other molecules, which is better explained by creation than by evolution. (b) The probability argument is founded on the high probability of creation, and the correspond-

ingly near-zero probability of evolution, of the least complex living organism, including its enzymes, other proteins, and DNA. (c) The isomer argument is based on the virtually universal presence of L-amino acids in proteins and D-sugars in nucleic acids. (d) The chemistry argument centers on the chemical tendency away from life rather than toward life. (e) The thermodynamics argument is based on the complexity of the first life being more plausibly explained by creation than by evolution. These lines of evidence for biological creation have been articulated by biophysicist Dean H. Kenyon, a creationist professor of biology at San Francisco State University with an earned Ph.D degree from Stanford.471/ These are material factual issues.

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471. Affidavit of Professor Dean H. Kenyon (attached as Exhibit I). Kenyon has

(a) Information Content Argument for Biochemical Creation. Information content

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published elsewhere the (a-b) information content argument, (c) isomer argument, (d) chemistry argument, and (e) thermodynamics argument:

> [a-b] At the heart of the molecular activity of all living cells is the genetic coding and protein-synthesizing machinery which stores and translates biologic information. This information is contained in the specific linear sequences of the subunits of DNA, RNA and proteins. At least 20 different proteins are required for the replication of DNA. At least another 50 proteins are needed to transcribe and translate the i nformation stored in the DNA molecules into the amino acid sequences of proteins (J. Fox 1978; Sheeler and Bianchi 1980).
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> . . ..
>
> [c] Another intractable problem concerns the spontaneous origin of the optical isomer preferences found universally in living matter (e.g., L- rather than D-amino acids in proteins, D- rather than L-sugars in nucleic acids).
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> . . ..
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> [d] Creationists maintain that laboratory studies have shown that simple organic matter does not move in the direction of the living state; it does move in other directions, the most prominent of which is the formation of non-biological macromolecular

is a measure of the difference between a random arrangement and a meaningfully ordered arrangement. The information content argument is based on the vast information content (i) of the least complex single-celled organism, (ii) of the genetic coding system of the cell and of other complex molecules. This information content is so great that it affirmatively supports biochemical creation and undercuts biochemical evolution, as Haskings* reluctantly conceded in connection with the genetic coding

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material.

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[e] Another especially helpful feature is the detailed discussion of the implications of thermodynamics (Chaps. 7, 8, and 9) for the origin-of-life problem. This important topic is either omitted entirely or is treated superficially in most other books on the chemical origins of life.

Kenyon, Foreword to C. Thaxton, W. Bradley & R. Olsen, The Mystery of Life's Origin v-vi (1984); Kenyon, The Creationist View of Biologic Origins, NEXA Journal, Spring 1984, at 28, 30-31.

system:

> Did the code and the means of translating it appear simultaneously in evolution? It seems almost incredible that any such coincidences could have occurred, given the extraordinary complexities of both sides and the requirement that they be coordinated accurately for survival. By a pre-Darwinian (or a skeptic of evolution after Darwin) this puzzle surely would have been interpreted as the most powerful sort of evidence for special creation.472/

(i) The least complex single-celled organism has a vast information content "comparable to 100,000,000 pages of the Encyclopaedia Britannica, according to Sagan*

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472. Haskings*, Advances and Challenges in Science in 1970. 59 American Scientist 305, ____(1971). Accord, F. Hoyle, The Intelligent Universe: A New View Of Creation and Evolution 243 (1983) ("When this problem is considered in detail--in the way we have done in this book--it is apparent that the origin of life is overwhelmingly a matter of arrangement, of ordering quite common atoms into very special structures and sequences. Whereas we learn in physics that non-living processes tend to destroy order, intelligent control is particularly effective at producing order out of chaos.")

(an ACLU witness):

> Human cells are in many fundamental respects similar to those that make up all the other animals and plants on the earth. Each cell typically consists of a central, usually spherical, nucleus and an outer more heterogeneous region, termed the cytoplasm. The substance of nucleus and cytoplasm together has for many decades been called protoplasm. . . . A living cell is a marvel of detailed and complex architecture. Seen through a microscope there is an appearance of almost frenetic activity. On a deeper level it is known that molecules are being synthesized at an enormous rate. Almost any enzyme catalyzes the synthesis of more than 100 other molecules per second. In ten minutes, a sizable fraction of the total mass of a metabolizing bacterial cell has been synthesized. The information content of a simple cell has been estimated as around 1012 bits, comparable to about 100 million pages of the Encyclopaedia Britannica.473/

This difference between nonlife and the least complex life is so great that that transformation is "at least as great"

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473. Sagan*, Life, 10 Encyclopaedia Britannica: Macropaedia 893, 894 (15th ed. 1974).

as the alleged transformation from the least complex life to man:

> Above the level of the virus, the simplest fully living unit is almost incredibly complex. It has become commonplace to speak of evolution from amoeba to man, as if the amoeba were the simple beginning of the process. On the contrary, if, as must almost necessarily be true, life arose as a simple molecular system, the progression from this state to that of the amoeba is at least as great as from amoeba to man.474/

Yockey*, an information scientist with a Ph.D. degree from Berkeley, has calculated the information content of the least complex life, and has concluded that only a nonliving protein could have evolved in a billion years:

> Taking into account only the effect of the racemic mixture the longest genome which would be expected with 95% confidence in 109 years corresponds to only 49 amino acid residues. This is much too short to code a living system so evolution to higher forms could not

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474. G. Simpson*, The Meaning of Evolution 15-16 (1949).

> get started. Geological evidence for the "warm little pond" is missing. . . .
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> . . ..
>
> Clearly 109 years is far too short a time and the universe is far too small for the goddess to select even one molecule of cytochrome c from the primitive milieu. Therefore a belief that proteins basic for life as we know it appeared spontaneously in the primitive milieu on earth is based on faith.475/

(ii) The genetic coding system in the least complex cell is very complex, and includes DNA and RNA (which are nucleic acids made up of double chains of hundreds of nucleotides per gene), ribosomes (which translate messenger RNA into the amino acid sequences of proteins), at least 70 enzymes and other proteins (which are necessary in transcribing and translating the DNA), ATP (which is the energy source), and a supply of nucleotides.476/ This genetic coding

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475. Yockey*, A Calculation of the Probability of Spontaneous Biogenesis by Information Theory, 67 Journal of Theoretical Biology 377, 377 (1977). Cf. Section 2[b](1)(b) infra (probability argument).

system even includes a checking mechanism.477/ The fifty or more essential components of the genetic coding system are themselves produced by the genetic coding system, as Popper* observes:

> What makes the origin of life and of the genetic code a disturbing riddle is this: the genetic code is without any biological function unless it is translated; that is, unless it leads to the synthesis of the proteins whose structure is laid down by the code. But, as Monod points out, the machinery by which the cell [at least the nonprimitive cell which is the only one we know] translates the code "con-

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476. E.g., T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 21-28 (1977); S. Luria*, S. Gould* & S. Singer*, A View of Life 71-75 (1981).

477. Cell's Energy Use High for Protein Synthesis, 6 Chemical and Engineering News (August 20, 1979) ("Most of that energy, perhaps many times more than previously supposed, is used for proofreading processes that ensure the accuracy of such synthesis, according to Michael A. Savageau and Rolf R. Freter of the University of Michigan, Ann Arbor. Living cells are fastidious about their proteins, checking and doublechecking them at particular stages during synthesis."); Geseron*, _____ 66 American Scientist 207 (1978).

> sists of at least fifty macromolecular components which are themselves coded in DNA." Thus the code cannot be translated except by using certain products of its translation. This constitutes a really baffling circle: a vicious circle, it seems, for any attempt to form a model, or theory, of the genesis of the genetic code.478/

Looking beyond individual genes to chromosomes (which are made up of many genes),

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478. Popper*, _____, in Studies in the Philosophy of Biology ____, 259 (1974), quoting J. Monod*, Chance and Necessity 143 (1971). Accord, E. Ambrose*, The Nature and Origin of the Biological World 135 (1982)("But the enzymes only work because the protein chains are coded in a special sequence by DNA. DNA can only replicate with the help of protein enzymes. We really are in a chicken and egg situation!"); Salisbury*, Doubts About the Modern Synthetic Theory of Evolution, 33 American Biology Teacher 335, 338 (1971) ("It's as though everything must happen at once: the entire system must come into being as one unit, or it is worthless."). The origin of the genetic coding system cannot be discussed without the origin of the mechanism of protein synthesis being discussed. Crick*, _____, 38 Journal of Molecular Biology 367 (1968); Woese*, _____, in Progress in Molecular and Subcellular Biology ____, ____ (Hahn, Puck, Springer, & Wallefels eds. 1969).

"the information encoded in a single human chromosome is equivalent to several thousand volumes of small print."479/ The information content of this genetic coding system is so great that Schutzenberger* of University of Paris and other scientists concluded at a conference on the mathematical probability problems facing evolution:

> Thus, to conclude, we believe that there is a considerable gap in the neo-Darwinian theory of evolution, and we believe this gap to be of such a nature that it cannot be bridged within the current conception of biology.480/

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479. Leslie*, Cosmology, Probability, and the Need to Explain Life, in Scientific Explanation and Understanding 53, 64-65 (N. Rescher ed. 1983).

480. Schutzenberger*, Algorithms and the Neo-Darwinian Theory of Evolution, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution, 73-80 (P. Moorehead & M Kapln eds., 1967). Accord, Orgel*, Darwinism at the Very Beginning of Life, 94 New Scientist 151 (1982) ("We do not yet understand even the general features of the origin of the genetic code . . .. The origin of the genetic code is the most baffling aspect of the problem of the origins of life, and a major conceptual

The presence of such a vast information content in the first life and in all life points to an abrupt appearance of complex information: biochemical creation. This information content argument supports the scientific nature of creation-science, which is a material factual issue.

(b) Probability Argument for Biochemical Creation. The probability argument is based on the higher mathematical probability of creation, and the near-zero probability of evolution, (i) of the least complex life, and (ii) of its enzymes, other proteins, and DNA.

(i) The least complex single-celled organism such as E. coli has DNA chains that are so complex that the probability of the arrangement is 1 chance in 102,000,000 (which represents 10 followed by 2 million zeros), according to Ambrose*:

When we come to examine the sim-

> plest known organism capable of independent existence, the situation becomes even more fantastic. In the DNA chain of the chromosome of the bacterium E. coli, a favourite organism used by molecular biologists, the [DNA] helix consists of 3-4 million base pairs. These are all arranged in a sequence that is 'meaningful' in the sense that it gives rise to enzyme molecules which fit the various metabolites and products used by the cell. This unique sequence represents a choice of one out of 102,000,000 alternative ways of arranging the bases! We are compelled to conclude that the origin of the first life was a unique event, which cannot be discussed in terms of probability.481/

Looked at another way, in 5 billion years evolution would at best produce a single pair of genes of E. coli (corresponding to a tiny part of the full DNA chain), and that only if the entire earth were covered with an inch-thick layer of E. coli for that period, according to Eden* of MIT.482/

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or experimental breakthrough may be needed before we can make any substantial progress.").

481. E. Ambrose*, The Nature and Origin of the Biological World 135 (1982).

The probability of a single-celled organism evolving is calculated to be one chance in 1078,436 by Hadd*, 1 chance in 10450 by Golay* for the simplest imaginable organism, and a "vanishingly small" probability by Nobel Prize winner Prigogine*.483/ These

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482. Eden*, Inadequacies of Neo-Darwinian Evolution as a Scientific Theory, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution ____, 9 (P. Moorehead* & M. Kaplan* eds. 1982).

483. Hadd*, _____, _____ 31 (19__); Golay*, Reflections of a Communications Engineer, 33 Analytical Chemistry 23 (June 1961); Prigogine*, Nicolis* & Babloyants*, Thermodynamics of Evolution, Physics Today, Nov. 1972, at 23, _____ ("The probability that at ordinary temperatures a macroscopic number of molecules is assembled to give rise to the highly ordered structures and to the coordinated functions characterizing living organisms is vanishingly small. The idea of spontaneous genesis of life in its present form is therefore highly improbable even on the scale of the billions of years during which prebiotic evolution occurred."). Accord, Keosian*, Life's Beginnings--Origin or Evolution?, in Cosmochemical Evolution and the Origins of Life ___, 291 (J. Oró et al. eds. 1974) ("[T]he simplest heterotrophic cell is an intricate structual and metabolic unit of harmoniously coordinated

numbers are so vast that the number of protein molecules that could have existed on earth in 10 billion years is still an "infinitesimal" fraction.484/

(ii) The enzymes, other proteins, and DNA in even the least complex organism confront similar probabilities of creation and improbabilities of evolution. For enzymes, the probability of the 2,000 human enzymes is calculated at 1 chance in 1040,000 by Hoyle and Wickramasinghe (chairman of department of applied mathematics at University of Cardiff); and they describe that figure as faced even if the whole universe

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parts and chemical pathways. Its spontaneous assembly out of the environment, granting the unlikely simultaneous presence of all the parts, is not a believable possibility.").

484. Eden*, _____, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution _____, _____ (P. Moorehead* & M. Kaplan* eds. 1967).

consisted of organic soup."485/ For proteins, the probability of evolution of a simple protein is set at a mere 1 chance in 10130 by Lovell*, and similar calculations are made by Blum*:

> To form a polypeptide chain of a protein containing one hundred amino acids represents a choice of one out of 10130 possibilities. Here again, there is no evidence suggesting that one sequence is more stable than another, energetically. The total number of hydrogen atoms in the universe is only 1078. Lovell points out that the probability of forming one of these polypeptide chains by chance is unimaginably small; within the boundary of conditions of time and space we are considering it is effectively zero.486/

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485. F. Hoyle & N. Wickramasinghe, Evolution from Space 24 (1981).

486. E. Ambrose*, The Nature and Origin of the Biological World 135 (1982). Accord, H. Blum*, Time's Arrow and Evolution 158 (3d ed. 1968) ("But the question arises as to how these amino acids could have become joined together into polypeptide chains. It is commonly assumed today that life arose in the oceans, J. B. S. Haldane's "dilute hot soup" providing a supposedly appropriate medium. But even if this soup contained a goodly concentration

This means that 10243 years would be required for evolution of a single protein (and the earth is believed to be less than 1010 years old), according to du Nouy*, and also Stokes* and Hoyle.487/ The probability

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of amino acids, the chances of their forming spontaneously into long chains would seem remote. . . . [T]he probability of forming a polypeptide of only ten amino acid units would be something like 10-20. The spontaneous formation of a polypeptide of the size of the smallest known proteins seems beyond all probability. This calculation alone presents serious objection to the idea that all living systems are descended from a single protein molecule, which was formed as a "chance" act--a view that has been frequently entertained."). A "moderate-sized protein" may have 150 amino acids. F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 340 (1979).

487. L. du Nouy*, Human Destiny 34 (_____ trans. 1947) ("time needed to form, on an average, one such molecule in a material volume equal to that of our terrestrial globe is about 10243 billion years."); W. Stokes, Essentials of Earth History 186 (4th ed. 1982) ("The problem of synthesizing one simple protein of about 300 amino acids has been cited. . . . A chain of 1000 nucleotides made of the four basic units might exist in any of 41,000 ways, but only one will form the protein

of evolution of a cytochrome c molecule is only 1 chance in 1094, in the view of Yockey*.488/ Finally, for DNA, the probability

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being sought. The chance that the correct sequence would be achieved by simple random combination is said to be so small that it would not occur during billions of years on billions of planets, each covered by a blanket of a concentrated watery solution of the necessary amino acids."); F. Hoyle & N. Wickramasinghe, Evolution from Space 148 (1981) ("If only ten amino acids of particular kinds are necessary at particular locations in a polypeptide chain for its proper functioning, the required arrangement (starting from an initially different arrangement) cannot be found by mutations, except as an outrageous fluke. Darwinian evolution is most unlikely to get even one polypeptide right, let alone the thousands on which living cells depend for their survival. This situation is well-known to geneticists and yet nobody seems prepared to blow the whistle decisively on the theory.").

488. Yockey*, A Calculation of the Probability of Spontaneous Biogenesis by Information Theory, 67 Journal of Theoretical Biology 377, 387 (1977) ("The number of sequences of cytochrome c is now 7.25 x 1060 the number of sequences for 101 sites, is 3.4 x 10154. Therefore the probability of selecting a member of the cytochrome c family with the same optical isomers in a given set of 101 rolls of the icosahedral dice is 2.15 x 10-94").

of evolution of a DNA chain to produce a medium protein is hardly 1 chance in 10600 --and 10600 DNA chains would fill many universes--according to Salisbury*.489/

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489. Salisbury*, Doubts about the Modern Synthetic Theory of Evolution, 33 American Biology Teacher 335, 336 (1971)("A medium protein might include about 300 amino acids. The DNA gene controlling this would have about 1,000 nucleotides in its chain. Since there are four kinds of nucleotides in a DNA chain, one consisting o f 1,000 links could exist in 41,000 different forms. Using a little algebra (logarithms), we can see that 41,000=10600. Ten multipled by itself 600 times gives the figure 1 followed by 600 zeros! . . . [I]magine how many universes it would take to accommodate 10600 DNA chains!"). Accord, Leslie*, Cosmology, Probability and the Need to Explain Life, in Scientific Explanation and Understanding 53, 64-65 (N. Rescher* ed. 1983) ("We can point also to the "improbable" left-handedness of almost all the amino acids found in life on earth, when left-handed and right-handed varieties are equally easily made in the laboratory; to the 'improbable' DNA molecule, a million times longer than it is wide; to estimates that the information encoded in a single human chromosome is equivalent to several thousand volumes of small print; to a large mammal's thousand trillion cells of about a thousand different varieties, and to how it took Evolution far longer to invent the

> These probabilities are unimaginably small:
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> The number of chemical events which can have occurred on earth or which can occur in the future up to the end of the earth's existence is certainly less than 1080; this is an enormous figure, but it is not infinite. "The impossibility threshold of any chemical phenomenon on earth is a probability of 10-100."490/

By way of illustration the ratio of one atom to all atoms in the known universe of billions of stars is about 1 to 1080.

The counterargument is sometimes made that numerous molecular combinations would work in producing life and biologically meaningful proteins and DNA. Hoyle replies:

> Despite its complexity, our biochemistry may well be the simplest form possible. Take, for example, sugars, the

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cell, so naively called 'simple,' than to make the leap to mammals; and so on.").

490. Lafont*, quoting G. Salet*, Chance and Certainty: Evolution in the Light of Modern Biology ___ (1972). Accord, E. Borel*, Probabilities and Life 28 (1962); E. Borel*, Elements of the Theory of Probability 57 (1965).

> main energy source of life. These are built up from the two commonest molecules in the Universe, the molecules of hydrogen and carbon monoxide. Thus the enzymes we use to unlock the energy content of sugars are engaged in processes which are central to the chemical content of the whole Universe. Hence there is nothing hole-in-the-corner about our terrestrial system. There are not vast billions of other equally likely systems. Indeed it is to be doubted whether there is even one other system that operates so fundamentally on molecules composed of the commonest atoms in the Universe, the atoms of carbon, oxygen, nitrogen and hydrogen.491/

This probability argument supports the scientific nature of creation-science, which is a material factual issue.

(c) Isomers Argument for Biochemical Creation. The isomers argument is based on the isomers (structural right- or left-handedness) found in living organisms. Isomers were discovered by the great biolo-

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491. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 18 (1983).

gist Pasteur the year after publication of The Origin of Species494/ and are described as follows:

> Sugars, amino acids and many other chemical compounds are asymmetrical molecules, which can exist in two forms, mirror images of each other (Fig. 51). These two forms can be detected by their effect on polarized light. A solution containing equal quantities of the two forms, 'left-handed' and 'right-handed' molecules, will transmit a beam of polarized light unchanged. But a solution containing mainly or only right-handed molecules will rotate the beam in one direction, and left-handed molecules will rotate it the other way. According to their effect on the beam, the two varieties are called laevo-rotary (to the left, abbreviated as 'L') and dextro-rotatory (to the right,'D').495/

The significant thing is that virtually all proteins are made exclusively of left-handed

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494. Williams* & Smith*, A Critical Evaluation of the Application of Amino Acid Racemization to Geochronology and Geothermometry, 8 Origins of LIfe 91, 91 (1977).

495. C. Patterson*, Evolution 157 (1978). Accord, W. Stansfield*, The Science of Evolution 84 (1977); 1 A Meister*, Biohemistry of the Amino Acids 113-17 (2d ed. 1965).

amino acids (L-amino acids) and virtually all nucleic acids are made exclusively of right-handed sugars (D-sugars) in living organisms, as all authorities agree.

> If a sugar or an amino acid is chemically synthesized in a testtube, the product will be a mixture of left-handed and righthanded molecules, in roughly equal numbers. But in living organisms of every sort, all the amino acids are L-amino acids, and in nucleic acids all the sugars are D-molecules.496/

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496. C. Patterson*, Evolution 157 (1978)(he interprets this as evidence that life originated only once). Accord, Williams* & Smith*, A Critical Evaluation of the Application of Amino Acid Racemization to Geochronology and Geothermometry, 8 Origins of Life 91, 91 (1977) ("Virtually all proteins contain exclusively the L-enantiomers of the amino acids while natural sugars are of the D-configuration."); A. Oparin*, Life, Its Nature, Origin and Development 59, 60 (1961) ; L. Pauling*, General Chemistry 774 (1970); W. Stansfield*, The Science of Evolution 84 (1977) ("All living organisms possess only the L-amino acid isomers in their proteins (excepting glycine)."); 1 A. Meister*, Biochemistry of the Amino Acids 113-117 (2d 1965); S. Bresler*, Introduction to Molecular Biology 6-7 (1971) ("By contrast, the proportion of L-amino acids in proteins is 100%.").

Even though the opposites are just as chemically possible, "life cannot and never could exist without molecular dissymmetry" (all protein amino acids being of the same handedness and all nucleic acids being of the same handedness), according to Terentév* and Klabunovskii* at the First International Symposium on the Origin of Life of Earth.[497]

The origin of these isomers, contrary to the equal mixture of left- and right-handedness under chemical laws, points to

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The amino acid glycine is neither left- nor right-handed; and D-amino acids appear in some bacteria, earthworms, insects, and antibiotics.

497. Williams* & Smith*, A Critical Evaluation of the Application of Amino Acid Racemization to Geochronology and Geothermometry, 8 Origins of Life 91, 91 (1977). See also S. Bresler*, Introduction to Molecular Biology 6 (1971) ("both stereoisomers are thermodynamically and kinetically identical"); C. Patterson*, Evolution 157 (1978) ("synthesized in a testtube, the product will be a mixture of left-handed and right-handed molecules, in roughly equal numbers").

biochemical creation. At the same time, "the origins of optical activity present problems to the hypothesis of chemical evolution that are at present insoluble," in the words of Bonner* and Briggs*.498/ This isomer argument supports the scientific nature of creation-science, which is a material factual issue.

(d) Chemistry Argument for Biochemical Creation. The chemistry argument involves

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498. Bonner*, _____, in Exobiology 170, _____ (C. Ponnamperuma* ed. 1972). Accord, S. Bresler*, Introduction to Molecular Biology 6 (1971) ("How and why the complete separation of stereoisomers in living tissue was started remains an enigma."); Williams* & Smith*, A Critical Evaluation of the Application of Amino Acid Racemization to Geochronology and Geothermometry, 8 Origins of Life 91, 91 (1977) ("There is no generally accepted theory for the origin of optical asymmetry."). The proposed explanations of selective binding to bentonite and selective adsorption have been rejected. _____*, Origins of Chirality in Nature: A Reassessment of the Postulated Role of Bentonite, 212 Science 1145, 1145 (1981); _____*, Life and a Lump of Clay, 116 Science News 200, 200 (1979).

the chemical tendency away from life, toward breakdown of chemical bonds outside of living organisms, rather than toward life. Some aspects of this tendency are summarized by Abelson*:

> First, there are limitations on what can be made by inorganic means; second, all organic . . . some substances are readily destroyed by radiation; fourth, many compounds would have been removed from the ocean by precipitation or absorption; fifth, there are serious chemical incompatibilities among the constituents of living matter, and some of the components of the soup would react to form nonbiologic substances. In view of these limitations, one is challenged to seek a series of steps toward life that are compatible with the environment.499/

Natural selection does not apply to preliving molecules, and so cannot be invoked to

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499. Abelson*, Chemical Events on the Primitive Earth, 55 Proc. National Academy of Sciences 1365, 1369 (1966). Accord, Hull* & Bernal*, Thermodynamics and Kinetics of Spontaneous Generation, 186 Nature 693, 694 (1960) ("Secondly, the reactions that are invoked to synthesize such compounds are seen to be much more effective in decomposing them.").

overcome the general chemical tendency, as discussed below.500/ This chemistry argument supports the scientific nature of creation-science, which is a material factual issue.

(e) Thermodynamics Argument for Biochemical Creation. The thermodynamics argument is based on the complexity of the first life being more plausibly explained by biochemical creation than by biochemical evolution. "The second law of thermodynamics is the postulate that: the entropy of an isolated system can never decrease."501/ Although the earth is not an isolated system and classical thermodynamics do not apply the second law of thermodynamics ap-

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500. Section 2[b](2)(c)(ix) infra.

501. W. Reynolds*, Thermodynamics 157 (2d ed. 19___). Accord, H. Blum* , Time's Arrow and Evolution 190 (3d ed. 19___); see Morowitz*, The Entropy Crisis, Hospital Practice, July 1974, at 32, 32.

plies to prelife compounds under the theory of nonequilibrium thermodynamics:

> The second law of thermodynamics applies not only to inorganic gases in the atmosphere but also to organic compounds in the ocean. Living cells may reverse the process, but in the absence of life, "die Entropie der Welt strebt einem Maximum zu."502/

The effect of the second law of thermodynam-

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502. Hull*, Thermodynamics and Kinetics of Spontaneous Generation, 186 Nature 693, 694 (1960). Accord, Walton*, _____, 4 Origins ____, 16 (1977) ("Nonequilibrium thermodynamics has been useful in clarifying the essential requirements of structure and energy for organization to develop in molecular systems and in providing new insights into how organisms work."); see H. Blum*, Time's Arrow and Evolution 15 (1968) ("Statements occasionally encountered, to the effect that living organisms do not obey the second law of thermodynamics, are usually based upon the idea that these systems are able to bring about a reduction of the entropy within themselves or their immediate surroundings. Such arguments are beside the point unless the whole thermodynamic balance sheet is taken into account, as their authors never seem to do."); H. Morowitz*, The Entropy Crisis, Hospital Practice, July 1974, at 32, 32, 37 ("organization in biology is basically rooted in entropic factors.").

ics under nonequilibrium theory is to make biochemical evolution "vanishingly" implausible, according to Nobel Price laureate Prigogine* and others*:

> The probability that at ordinary temperatures a macroscopic number of molecules is assembled to give rise to the highly ordered structures and to the coordinated functions characterizing living organisms is <u>vanishingly small</u>. The idea of spontaneous genesis of life in its present form is therefore highly improbable even on the scale of the billions of years during which prebiotic evolution occurred.<u>503</u>/

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503. Prigogine*, Nicolis* & Babloyantz*, <u>Thermodynamics of Evolution</u>, Physics Today, Nov. 1972, at 23, ____. A similar conclusion is reached by Yockey*:

> An uninvited guest (Schroedinger, 1955; du Nouy, 1947; Prigogine & Nicolis, 1971; Gatlin, 1972; Prigogine, Nicolis & Baboyantz, 1972; Vol'kenstein, 1973) at any discussion of the origin of life and of evolution from the materialistic reductionist point of view, is the role of <u>thermodynamic entropy</u> and the "heat death" of the universe which is predicts. The universe should in every way go from states which are less probable to those which are more probable. Therefore hot bodies cool; energy is conserved but be-

Instead, the origin of life is more plausibly explained by biochemical creation.

The counterargument is sometimes made that the formation of crystals overcomes the thermodynamic law of entropy, and shows that the biochemical evolution of the first life could also do so. Prigogine* and others* reject this argument:

> The point is that in a nonisolated system there exists a possibility for formation of ordered , low-entropy structures at sufficiently low temperatures. This ordering principle is responsible for the appearance of ordered structures such as crystals as well as for the phenomena of phase transitions.
>
> Unfortunately this principle

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comes less available to do work. According to this uninvited guest, the spontaneous generation of life is highly improbable (Prigogine, Nicolis & Babloyantz, 1972). The uninvited guest will not go away nor will the biological evidence to the contrary not withstanding.

Yockey*, A Calculation of the Probability of Spontaneous Biogenesis by Information Theory, 67 Journal of Theoretical Biology 377, 380 (1977).

cannot explain the formation of biological structures.504/

Another counterargument is that nonequilibrium thermodynamics overcomes the problem,

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504. Prigogine*, Nicolis* & Babloyantz*, Thermodynamics of Evolution, Physics Today, Nov. 1972, at 23, _____. Accord, Mora*, Crystallization and the Second Law, 199 Nature 216 (1963)("In crystallization, the full process is determined by the valency, the molecular structure of the components, whether atoms, molecules or polymers. Crystallization occurs because it leads to the lowest energy state and to the most stable arrangement of atoms or molecules under the given conditions. Crystallization leads to simple, very uniform repeating structures, which are inert. These structures do not function, and are not designed by function."); Strayropoulos*, Letter, 65 American Scientist 675, ____ (1977) ("He makes it appear as though crystals and highly ordered organic molecules belong to the same class, when in fact they do not. When a crystal is broken up, the smaller crystals are physically and chemically identical to the original. This is never observed with (organic) molecules; when the original molecule is split up lesser molecules appear, and part of the original information is lost. To ignore such fundamental differences in an effort to arrive at some general overview or law is to create a false overview, a pseudolaw."); Lipson*, A Physicist Looks at Evolution, 31 Physics Bulletin 138, 138 (1980).

but that is not the case.505/ This thermodynamics argument supports biochemical creation, which is a material factual issue.

Conclusion. Biochemical creation is scientific, not religious, and includes at least five scientific lines of argument. The information content, probability, isomer, chemistry, and thermodynamics arguments affirmatively support biochemical creation, and do not merely identify weaknesses of biological evolution. These are material factual issues.

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505. Walton*, _____, 4 Origins _____, 16 (1977) ("Nonequilibrium thermodynamics has been useful in clarifying the essential requirements of structure and energy for organization to develop in molecular systems and in providing new insights into how organisms work. The complexity of Eigen's hypoercycle or Cairns-Smith's "evolution machine" and suggested open system models destroy their credibility as the starting point of molecular evolution.").

(2) Noncompelling Status of Biochemical Evolution (of the First Life)

> All of us who study the origin of life find that the more we look into it, the more we feel that it is too complex to have evolved anywhere. We all believe as an article of faith that life evolved from dead matter on this planet. It is just that its complexity is so great that it is hard for us to imagine that it did.506/
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> --Nobel laureate Harold C. Urey

Biochemical evolution involves the alleged evolution in the primitive earth of amino acids, then proteins, then protocells and the genetic code, and finally the first living cell. Evolution includes "biochemical evolution" (or "chemical evolution"), as leading evolutionists Dobzhansky*, Ayala*, Stebbins* and Valentine* acknowledge:

> [T]he concept of evolution has been applied not only to the living world but to the nonbiological as well. Thus, we speak of the evolution of the entire universe , the solar system and the physical earth, apart from the organisms that inhabit it. As we shall

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506. Urey*, _____.

> show in Chapter 11 ("Cosmic Evolution and the Origin of Life"), the origin of life is best explained as the outcome of precellular chemical evolution, which took place over millions of years.507/

Other evolutionist authorities generally agree,508/ and "biochemical evolution" (or

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507. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 9 (1977).

508. Mayr*, another leading evolutionist, writes:

> Cosmic evolution and biolocical evolution have that much in common.
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> . . ..
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> [See "Chemical Evolution and the Origin of Life" by Richard E. Dickerson*, p. 70].

Mayr*, Evolution, Scientific American, Sept. 1978, at 47, 47, 51. Another such definition was given by Huxley*:

> it is evolution, in the broad sense, that links inorganic nature with life, and the stars with earth, and matter with mind, and animals with man.

Huxley*, At Random, in 3 Evolution after Darwin ____, 41-65 (S. Tax ed. 1960). Accord, E. Olson* & J. Robinson*, Concepts of Evolution, 10, (1975) ("Evolutionism is the doctrine that the universe, including inorganic and organic matter in all its manifestations, is the product of gradual and progressive development."); Wilson, The Origin of Life, in Did the Devil Make Darwin Do It? _____, _____ (D. Wilson*, ed. 1983).

"chemical evolution") is a generally accepted term,509/ although the ACLU as a

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("Evolution, which is the strongest natural explanation, holds that the gross features of the universe--including galaxies, solar systems and planets; the transition from non-living matter to living organisms; and the diversity of life forms, including human beings--all arose as a consequence of the innate proclivities of matter and energy, as expressed by the laws of nature."); G. Stebbins*, Darwin to DNA, Molecules to Humanity 174 (1982) ("Since it left no fossil record, this prebiotic phase of evolution cannot be determined by the same methods that scientists use to determine evolutionary sequences of organisms.").

509. E.g., Fox* & Dose*, ___, in Molecular Evolution and the Origin of Life (2d ed. S. Fox & K. Dose eds. 1977); The Origin of Life and Evolutionary Biochemistry (K. Dose, S. Fox, G. Deborin & T. Pavlovskaya* eds. 1974); M. Calvin*, Chemical Evolution (1969); Chemical Evolution and the Origin of Life (R. Buvet* & C. Ponnamperum* eds. 1971); Prebiotic and Biochemical Evolution (A. Kimball* & J. Oro* eds. 1971); T. Jukes*, Molecules and Evolution (1966); Biochemical Evolution and the Origin of Life (E. Schoffeniels* ed. 1971); Cowie*, Life in Pre-Cambrian and Early Cambrian Times, in The Fossil Record 17, 30 (W. Harland* et al. eds. 1967); DeFord*, Humanism and Atheism I, Humanist, July-Aug. 1971, at 5; G. Stebbins* & W. Fitch*, Processes of Molecular and Organismic Evolution (in press) (Chapter 8 on "The Major Events

matter of strategy in this case seeks to deny that.510/ The following description

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of Evolution: The origin of life . . ."); H. Blum*, Time's Arrow and Evolution 157 passim (3d ed. 1968); Committee on Science and Creation, Science and Creation: A View from the National Academy of Sciences 25, 26 (1984); P. Erlich*, R. Holm* & D. Parnell *, The Process of Evolution 3 (2d ed. 1974); Dickerson*, Chemical Evolution and the Origin of Life, in Evolution at 30 (E. Mayr* ed. 1978); Barghoorn*, The Oldest Fossils, Scientific American, May 1971, at 30, 41, 42; S. Tax* & C. Callendar*, Evolution after Darwin--The Evolution of Life: Its Origin, History and Future (1960); The Origin of Life and Evolutionary Biochemistry (K. Dose* ed.) 1974); Cosmochemical Evolution and the Origins of Life (J. Oro* & S. Miller* eds. 1974)(Fourth International Conference on the Origin of Life); Dickerson*, Chemical Evolution and the Origin of Life, 239 Scientific American 70 (Sept. 1978); D. Rohlfing* & A. Oparin*, Molecular Evolution: Prebiological and Biological (1972); M. Eigen*, Self-Replication and Molecular Evolution, in Evolution from Molecules to Man 105-30 (D. Bendall* ed. 1873) (section entitled "Molecular and Cellular Evolution"); M. Kimura*, Molecular Evolution, Protein Polymorphism, and Neutral Theory (1982); B. Kueppers*, Molecular Theory of Evolution: Outline of a Physicochemical Theory of the Origin of Life (1983); E. Terzaghi* & A. Wilkins*, Molecular Evolution (1983).

510. Memorandum of Plaintiffs in Support of Summary Judgment at _____, Aguil-

of biochemical evolution from a high school textbook used in Louisiana public schools is typical:

> The primitive earth may have had an atmosphere largely of hydrogen, which was later lost to space. A secondary atmosphere may have included ammonia, methane, water, and hydrogen sulfide (see diagram on page 836). Ultraviolet light from the sun, electrical storms, and decay of radioactive elements may have provided the energy to combine these molecules as sugars and amino acids. Amino acids could have combined to form proteins. . . . . .
>
> The first self-organizing, self-reproducing blobs could have appeared in an environment containing amino acids and protein-like substances, sugars, and possibly ATP as well as DNA and RNA. Many other molecules, including long chains of carbon and hydrogen in fatlike molecules, probably were also present. We can imagine the early living blobs feeding upon other organic molecules in the seas, until such "food" became scarce. Mutations that produced new proteins--enzymes capable of synthesizing needed molecules from simpler available materials--eventually must have occurred. Still other mutations eventually led to cells--cells

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lard v. Edwards, No. 81-4787 (E.D. La., filed Dec. 2, 1981).

> that could take energy from the sun and combine carbon dioxide and water into sugars and amino acids.511/

Similar summaries are given by evolutionist scientists.512/

The evidence for biochemical evolution is quite weak, as the above statement by Urey* and the following concluding of biochemist Kerkut* show:

> There is, however, little evidence in favour of biogenesis and as yet we

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511. Biological Sciences Curriculum Study*, Biolocical Science: An Inquiry into Life 837 (1973). Accord, n. 470 supra; Biological Science Curriculum Study*, Biological Science: An Inquiry into Life 100, 196, 703-08, 786, 836-37 (3d ed. 1973 & 1976); Biological Science Curriculum Study*, Biological Science: An Ecological Approach 277, 315-16, 396 (3d ed. 1973 & 1976); J. Otto*, A. Towle* & A. Madnick*, Modern Biology 149-50, 182 (1977); C. Heimler*, Focus on Life Sciences 69 (1977); R. Oram*, Biology: Living Systems 283-85 (3d ed. Teacher's ed. 1979).

512. E.g., T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 349-64 (1977) ; S. Luria*, S. Gould* & S. Singer*, A View of Life 686-90 (1981); G. Stebbins*, Darwin to DNA, Molecules to Humanity 174-84 (1982).

> have no indication that it can be performed. There are many schemes by which biogenesis could have occurred but these are still suggestive schemes and nothing more. They may indicate experiments that can be performed, but they tell us nothing about what actually happened some 1,000 million years ago. It is therefore a matter of faith on the part of the biologist that biogenesis did occur and he can choose whatever method of biogenesis happens to suit him personally; the evidence for what did happen is not available.513/

Hoyle is less charitable, and sees biochemical evolution as faith in a "miracle."514/

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513. G. Kerkut*, Implications of Evolution 150 (1960). Accord, Yockey*, Self Organization Origin of Life Scenarios and Information Theory, 91 Journal of Theoretical Biology 13, 13 (1981) ("It is concluded that at present there are no scientifically valid origin of life scenarios.")

514. Hoyle states:

> In [Biblical miracles'] place we now have miracles of a different sort, as for instance the miracle of the formation of galaxies after the big bang and the miracle of the origin of life in a feeble brew of organic soup, which the credulous believe to have happened in the early history of the Earth.

F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution ___ (1983). Yockey* notes the bias reflected by the biochemical evolutionist's search. Yockey*,

"Francis Crick, who shared a Nobel prize for the discovery of DNA, is one biophysicist who finds this theory unconvincing."541a/

Overview . The following Subsections discuss various aspects of biochemical evolution: the

(a) Early atmosphere, (b) "Primordial soup," (c) Evolutionary stages, (d) Laboratory experiments, and (e) Information content and probability questions.

Problems with the assumption of an oxygen-

A Calculation of the Probability of Spontaneous Biogenesis by Information Theory, 67 Journal of Theoretical Biology 377, 379 (1977) ("Research on the origin of life seems to be unique in that the conclusion has already been authoritatively accepted (Simpson, 1964; Eigen, 1971). What remains to be done is to find the scenarios which describe the detailed mechanisms and processes by which this happened.").

514a. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 23 (1983). Hoyle himself concludes that "there is not a shred of objective evidence to support the hypothesis that life began in an organic soup here on the Earth." Id.

free atmosphere are discussed in Subsection (a). Problems with the assumption of a "primordial soup" of necessary organic compounds are assessed in Subsection (b). Problems with the various evolutionary stages are treated in Subsection (c). Problems with extrapolating laboratory experiments made under controlled conditions are identified in Subsection (d). Finally, problems with obtaining the vast information content necessary for life, and overcoming the vast improbability of evolution, are discussed in Subsection (e). These are material factual issues. Although these scientific problems with biochemical evolution are discussed in such creationist books as The Mystery of Life's Origin,515/

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515. C. Thaxton, W. Bradley & R. Olsen, The Mystery of Life's Origin 1-187 (1984).

the documentation for the following discussion of these evolutionary problems comes instead from evolutionist books and articles.

(a) Problems with Assuming an Oxygen-Free Atmosphere for Biochemical Evolution. Proponents of biochemical evolution generally assume the existence of an oxygen-free atmosphere that contained high levels of methane and ammonia, because all biochemists agree that the presence of oxygen would preclude biochemical evolution:

> J. B. S. Haldane, the British biochemist, seems to have been the first to appreciate that a reducing atmosphere, one with no free oxygen, was a requirement for the evolution of life from nonliving organic matter.516/

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516. Dickerson*, Chemical Evolution and the Origin of Life, in Evolution at 30, 30-31 (E. Mayr* ed. 1978). He gives the dual reasons as follows:

> Without oxygen in the atmosphere there would have been no high-altitude ozone to block most of the ultraviolet radiation from the sun as there is

The recent arguments against an oxygen-free atmosphere are so strong that the "new orthodoxy" is becoming a belief in an oxygen-rich atmosphere:

> Biologists concerned with the origin of life still often quote an early atmosphere consisting of reduced gases, but this seems to stem as much

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> today. The unblocked ultraviolet radiation reaching the surface of the planet could have then provided the energy for the synthesis of a great many organic compounds from molecules such as water, carbon dioxide and ammonia. Without free oxygen in the atmosphere to destroy them again such compounds would have accumulated in the oceans until, in Haldane's words, "the primitive oceans reached the consistency of hot dilute soup."

Id. Accord, S. Fox* & K. Dose*, Molecular Evolution and the Origin of Life 44 (1972) ("chemical evolution . . . would be largely inhibited by oxygen"); Miller*, Production of Some Organic Compounds under Possible Primitive Earth Conditions, 77 Journal of American Chemical Society 2351, 2361 (1955) ("the organic compounds that make up living systems cannot be synthesized in an oxidizing atmosphere."); Brinkmann*, _____, 74 Journal of Geophysical Research 5355, 5356 (1969) ("It does not seem that early [biochemical] evolution could have proceeded in such an atmosphere.").

> from ignorance of recent advances as from active opposition to them. In the latter part of the 1970s, the concept of early oxidized atmospheres on the terrestrial planets is becoming the new orthodoxy.517/

The primary argument for an oxygen-free atmosphere, and the three major problems with it and arguments for an oxygen-rich atmosphere, are discussed in the following Sections.

Geology Argument. The major argument

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517. Henderson-Sellers*, Benlow* & Meadows*, The Early Atmospheres of the Terrestrial Planets, 21 Quarterly Journal of Royal Astronomical Society 74, 81 (1980). Accord, Smaller planets began with oxidized atmospheres, 94 New Scientist 112 (1980) ("The time has come, it seems, to accept as the new orthodoxy the idea of early oxidized atmospheres on all three terrestrial planets, and the biological primers which still tell of life on Earth starting out from a methane/ammonia atmosphere energised by electric storms and solar ultraviolet need to be rewritten."); see J. Keosian*, The Origin of Life 27 (2d ed. 1968) ("There is no general agreement on what constitutes 'primitive earth conditions,' and the diversity of reaction mixtures and energy sources listed in Table 4-2 reflects the dissension.").

for an oxygen-free atmosphere is the geology argument that certain mineral forms found in the earth, such as red beds of oxidized sediments, appear only in newer strata and not older strata, and thereby indicate the absence of oxygen when the oldest strata were deposited. However, the geological features that should exist to provide evidence of an ancient oxygen-free atmosphere are "missing," according to Clemmey* and Badham*:

> Geological evidence often presented in favor of an early anoxic atmosphere is both contentious and ambiguous. The features that should be present in the geologic record had there been such an atmosphere seem to be missing. Many of the features advanced in support of an anoxic model can be ascribed to diagenetic alterations, and most diagenetic environments are reducing [oxygen-free].518/

5.8. Clemmey* & Badham*, Oxygen in the Precambrian Atmosphere: An Evaluation of the Geological Evidence, 10 Geology 141, 141-42 (1982). Abelson* similarly concludes: In this paper the nature of the primi-

The absence of red beds in older sediments probably results only from their decomposition,519/ and other features similarly do

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> tive atmosphere and ocean is considered in the light of geologic and geophysical information. The hypothesis of an early methane-ammonia atmosphere is found to be without solid foundation and indeed is contraindicated. Geologists favor an alternative view--that genesis of air and oceans is a result of planetary outgassing. . . .
>
> If the methane-ammonia hypothesis were correct, there should be geochemical evidence supporting it. What is the evidence for a primitive methane-ammonia atmosphere on earth? The answer is that there is no evidence for it, but much against it. . . .
>
> If large amounts of methane had ever been present in the earth's atmosphere, geologic evidence for it should also be available. Laboratory experiments show that one consequence of irradiating a dense, highly reducing atmosphere is the production of hydrophobic organic molecules which are adsorbed by sedimenting clays. The earliest rocks should contain an unusually large proportion of carbon or organic chemicals. This is not the case.

Abelson*, Chemical Events on the Primitive Earth, 55 Proc. National Academy of Sciences 1365, 1365 (1966). Accord, Dimroth* & Kimberley*, Precambrian Atmospheric Oxygen:

not require an oxygen-free atmosphere.520/

Evidence in the Sedimentary Distributions of Carbon, Sulfur, Uranium, and Iron, 13 Can. J. Earth Sci. 1161 ____ (1976) ("In general, we find no evidence in the sedimentary distribution of carbon, sulfur, uranium, or iron that an oxygen-free atmosphere has existed at any time during the span of geological history recorded in well-preserved sedimentary rock.").

519. Clemmey* & Badham* write:

> Perhaps the most important conclusion is that diagenesis is the factor most overlooked in interpreting the geologic record. Diagenesis destroys red beds by pigment aging; it results in the replacement of ancient evaporites by silica, carbonate, and feldspar; it causes ferruginization of pre-existing rocks to give us many of the banded iron formations; and recognition of many diagenetic phenomena that involve oxidative reactions, or require such reactions as a prior step, provides evidence for atmospheric oxygen. Whole-rock chemistry may even be changed by equilibration with the diagenetic environment, and the most diagenetic environments are reducing (Curtis, 1978).

Clemmey* & Badham*, Oxygen in the Precambrian Atmosphere: An Evaluation of the Geological Evidence, 10 Geology 141, 141-42 (1982). Accord, F. Pettijohn*, Sedimentary Rocks, 596 (3d ed. 1976) (lack of red color in earlier Precambrian Sediments may result only from flyschlike composition of much Archaean sediments).

Overall, Kerr* concludes:

> No geological or geochemical evidence collected in the last 30 years favors a strongly reducing primitive atmosphere. . . . Only the success of the laboratory experiments recommends it.521/

(ii) Geology Problems. One serious problem with the assumption of an oxygen-free atmosphere is that much geological evidence "favor[s] an early oxidized atmosphere":

> Recent biological and interplanetary studies seem to favor an early oxi-

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520. Pettijohn* concludes that the high ferrous-ferric iron ratio in some Precambrian rocks may result from metamorphic reductions rather than an oxygen-free atmosphere, and sulphide and sideritic sediments can be deposited in an oxygen-rich atmosphere. F. Pettijohn*, Sedimentary Rocks 596 (3d ed. 1976). Walker* argues that detrital uraninite and pyrite do not require an oxygen-free atmosphere. __. Walker*, Evolution of the Atmosphere 262 (1977).

521. Kerr*, _____, 42 Science 210 (1980). Accord, Cowen*, _____ Technology Review Apr. 1981, at _____, 8; S. Fox* & K. Dose*, Molecular Evolution and the Origin of Life 43 (1972).

> dized atmosphere rich in CO_2 and possibly containing free molecular oxygen. The existence of early red beds, sea and groundwater sulphate, oxidized terrestrial and sea-floor weathering crusts, and the distribution of ferric iron in sedimentary rocks are geological observations and inferences compatible with the biological and planetary predictions. It is suggested that from the time of the earliest dated rocks at 3.7 b.y. ago, Earth had an oxygenic atmosphere.522/

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522. Clemmey* & Badham*, Oxygen in the Precambrian Atmosphere: An Evaluation of the Geological Evidence, 10 Geology 141, 141 (1982). The authors give further specifics:

> We have tried to show here that the geologic data do not seem to support the notion of an anoxic atmosphere 3.7 to 1.9 b.y. ago, and we suggest that it provides ample evidence to the contrary: (1) Ferric iron minerals have been an abundant component of sedimentary rocks since 3.8 b.y. ago; (2) red beds are present in the geologic record from the Archean onward; (3) surface and submarine oxidized weathering crusts are found in the Archean onward; and (4) sulphate seems to have been present in the sea and fresh water from the Archaen. It seems also that the ower Proterozoic pyritic and uraniferous conglomerates may not be used as evidence for either a reducing or an anoxic atmosphere.

Id. at 145.

"The sedimentary distributions of carbon, sulfur, uranium, and ferric and ferrous iron depend greatly upon ambient oxygen pressure," and the "similar distributions of these elements in sedimentary rocks of all ages are here interpreted to indicate the existence of a Precambrian atmosphere containing much oxygen," in the views of Dimroth* and Kimberley*.523/ The presence of oxidized iron sediments and limestone deposits similarly points to the existence of an oxygen-rich atmosphere.524/

(iii) Photolysis of Water Problem. Another serious problem for the oxygen-free

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523. Dimroth* & Kimberley*, Precambrian Atmospheric Oxygen: Evidence in the Sedimentary Distribution of Carbon, Sulfur, Uranium, and Iron, 13 Canadian Journal of Earth Sciences 1161, 1161 (1976).

524. Davidson*, _____, 53 Proc. National Academy of Science 1194, _____ (1965) (hematite); J. Walker*, Pure Applied Geophysics 116, 230 (1978) (banded iron formations dated at 3.8 billion years).

atmosphere assumption is that ultraviolet light would have split (by photolysis) water vapor in the upper atmosphere into oxygen and hydrogen, in quantities greater than surface minerals could adequately absorb. Because of photolysis of water vapor, Brinkmann* has calculated that the atmosphere has essentially always had at least a quarter of its present level of oxygen,525/ and Carver* has recalculated the data and concluded that the ancient atmosphere had about a tenth of its present level of oxygen.526/ Many other researchers have similarly concluded that photolysis would have produced significant levels of atmospheric

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525. Brinkmann*, _____, 74 Journal of Geophysics Research 5355, ___ (1969). Although Brinkmann's* assumptions were questioned, the recalculation by Carver* shows his conclusion about a significant oxygen level to be correct.

526. Carver*, _____, 292 Nature 136 (1981).

oxygen in the early atmosphere.527/

(iv) Photodissociation of Other Gases Problem. Another problem is that ultraviolet light would have caused the breakdown of ammonia, which is essential to biochemical evolution hypotheses, in a mere 10 through 30,000 years.528/ It would have polymerized methane, which is also essential.529/ Ultraviolet radiation would also

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527. Davidson*, _____, 53 Proc. National Academy of Science 1194, (1965); Dimroth* & Kimberley*, Precambrian Atmospheric Oxygen: Evidence in the Sedimentary Distributions of Carbon, Sulfur, Uranium, and Iron 13 Can. Journal of Earth Sciences 1161, _____ (1976); Walton*, _____ 3 Origins 66.

528. Ableson*,_____, Proc., National Academy of Science 1365 (1966); Ferris* & Nicodem*, _____ _____, 238 Nature 268 (1972); Ferris* & Nicodem*, in The Origin of Life and Evolutionary Biochemistry 107 (K. Dose* et al. eds. 1974); Kuhn* & Atreya*, _____ _____, 37 Icarus 207 (1979); Levine*, _____, 18 Journal of Molecular Evolution 161 (1982).

529. Abelson*, _____ 55 Proc. National Academy of Science 1365 (1966); Cloud*, _____, 160

have broken down (photodissociated) formaldehyde rapidly,530/ and hydrogen sulphide in a mere 10,000 years.531/ Even without photodissociation, the amounts of formaldehyde and hydrogen sulphide have been greatly overestimated in possible amount.532/

Summary. The oxygen-free early atmos-

Science 729 (1968); Lasaga*, Holland* & Dwyer*, _____, 174 Science 53 (1971). (1976).

530. Pinto*, Gladstone* & Yung*, _____, 210 Science 1983 (1980); C. Ellis* & A. Wells*, The Chemical Action of Ultraviolet Rays 417 (1941); Abelson*, _____, Proc. National Academy of Science 1365 (19__); Hulett*, _____ 24 Journal of Theoretical Biology 56 (1969); Hulett*, _____, in Proceedings of the Fourth Conference on Origins of Life: Chemistry and Radioastronomy, 80 (L. Margulis* ed 1973).

531. Ferris* & Nicodem*, _____, Nature 268 (19__); Ferris* & Nicodem*, _____ in The Origin of Life and Evolutionary Biochemistry, 107 (19__); Miller*, Urey* & Oro*, _____, 9 Journal of Molecular Evolution 59 (1976).

532. Hulett*, _____, 174 Science 1038 (1971); Hulett*, _____, 24 Journal of Theoretical Biology 56 (1969).

phere that is essential to biochemical evolution is more a matter of wishful thinking than of scientific fact, and strong scientific evidence directly contradicts the possibility of such an atmosphere. This poses a material factual issue about the noncompelling nature of evolution and the scientific nature of creation-science.

(b) Problems with Assuming a Primordial Soup of Organic Compounds for Biochemical Evolution. Biochemical evolutionists also assume the existence of a "primordial soup" that was rich in certain organic compounds, which would be essential for the possible formation of amino acids, proteins, the genetic coding system, protocells, and other evolutionary stages.535/ There are a number of problems with this assumption of a primordial soup, including (i) conflict

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535. Note 512 supra.

with the geological evidence, (ii) destruction of any such compounds by cross-reactions, (iii) destruction of such compounds by radiation, and (iv) prevention of biochemical evolution by dilution. Overall,

> The physical chemist, guided by the proved principles of chemical thermodynamics and kinetics, cannot offer any encouragement to the biochemist, who needs an ocean full of organic compounds to form even lifeless coacervates.536/

(i) Geologic Problem. The first problem with the assumption of a "primordial soup" is that the geological remains it would have left do not appear to exist:

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536. Hull*, Thermodynamics and Kinetics of Spontaneous Generation, 186 Nature 693, 694 (1960). Darwin* himself recognized this problem. 2 The Life and Letters of Charles Darwin, 202 (F. Darwin* ed. 1887) ("But if (and oh! what a big if!) we could conceive in some warm little pond, with all sorts of ammonia and phosphoric salts, light, heat, electricity, etc., present, that a protein compound was chemically formed ready to undergo still more complex changes, ...").

> If there ever was a primitive soup, then we would expect to find at least somewhere on this planet either massive sediments containing enormous amounts of the various nitrogenous organic compounds, amino acids, purines, pyrimidines, and the like, or alternatively in much metamorphosed sediments we should find vast amounts of nitrogenous cokes (graphite-like nitrogen-containing materials). In fact, no such materials have been found anywhere on earth.
>
> There is, in other words, pretty good negative evidence that there never was a primitive organic soup on this planet that could have lasted but a brief moment.537/

Similarly, there is no geological evidence of the evaporating pools that most evolutionists postulate.538/

(ii) Cross-Reaction Problem. Another problem with the assumption of a primordial soup is that cross-reactions would occur that would destroy many of the organic com-

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537. J. Brooks* & G. Shaw*, Origins and Development of Living Systems 360 (1973).

538. Dose*, _____, in The Origin of Life and Evolutionary Biochemistry __, 75 (K. Dose et al. eds. 1974).

pounds in that soup, as Abelson* recognizes:

> In addition, carbohydrates such as glucose combine readily with amino acids to form nonbiologic products. This reaction proceeds at room temperature, and even a 0 degrees C there is a noticeable reaction in a week. At pH 8-9, amino acids and free carbohydrates are simply incompatible. . . . Thus it is unlikely that the primitive ocean ever contained more than traces of free glucose, free ribose, or deoxyribose.
>
> . . . .
>
> Fatty acids form insoluble salts with magnesium and calcium, and hence would be removed from the soup. At least five major factors limit the kinds of compounds that might have accumulated in the primitive ocean. [T]here are serious chemical incompatibilities among the constituents of living matter, and some of the components of the soup would react to form nonbiologic substances.539/

Amino acids would tend to combine with sugars or aldehydes, or with amines, ketones, or carboxylic acids forming non-biological

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539. Abelson*, Chemical Events on the Primitive Earth, 55 Proc. National Academy of Science 1365, 1369 (1966). Accord, Wrighton*, Photochemistry, Chemical and Engineering News (Sept. 3, 1979).

compounds.540/ Proteins would have tended to react with formaldehyde to form cross-linkages between proteins.541/

(iii) Radiation Problem. Another problem with the alleged primordial soup is that about 97% of amino acids formed would never have reached the primordial soup, if amino acids were formed in the atmosphere, because they would have been destroyed by ultraviolet light.542/ Ultraviolet light similarly would have destroyed most amino acids and

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540. Nissenbaum*, _____, 7 Origins of Life 413 (1976).

541. J. Walker*, Formaldehyde 399 passim (3d ed. 1964).

542. Hull*, Thermodynamics and Kinetics of Spontaneous Generation, 186 Nature 693, 693 (1960) ("A glycine molecule formed in such an atmosphere is immediately vulnerable to radiation up to 3000A., absorbing in a part of the solar spectrum far more intense than that which produced it. Decarbocylation of activated glycine would presumably occur with a quantum efficiency of the order of unity. Thus, any glycine formed would be rapidly decomposed. . . . Thus, 97 per cent of the glycine would be decomposed before it could reach the surface.")

proteins, if they formed in the ocean, because currents would have brought them near the surface exposed to ultraviolet light.543/

(iv) Dilution Problem. A further problem with the alleged primordial soup is dilution, if that soup were the ocean. Nissenbaum* has stated:

> It is difficult to see how, under such conditions, the "primordial soup" could have existed at all.
>
> . . ..
>
> [I]t is now generally accepted that the concentration of the "soup" was prob-

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543. Id., ("But even after the glycine reaches the ocean, the victory is not won. Abelson has discussed the possible stability of simple amino-acids throughout geological time; the important effect, however, is not thermal, but decomposition by ultraviolet radiation. The ultra-violet reaching the surface would penecrate to a considerable depth. . . . These short lives for decomposition in the atmosphere or ocean clearly preclude the possibility of accumulating useful concentrations of organic compounds over eons of time.") (ignoring destructive cross-reactions). Accord, Berkner* & Marshall*, _____, 22 Journal of Atmospheric Physics 225 (1965) (ultraviolet light would have penetrated several tens of meters beneath the surface).

ably too small for efficient synthesis, particularly of biopolymers.544/

Even if amino acids had been formed, they generally would be destroyed by cross-reactions and by ultraviolet radiation that were discussed above. The maximum amino concentration in the primitive ocean has been calculated to be "hopelessly low as starting material for the spontaneous generation of live," in Hull's* words.545/ Some biochemical evolutionists have proposed

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544. Nissenbaum*, Kenyon* & Oro*, _____, 6 Journal of Molecular Evolution ___, 253, 259 (1975).

545. Hull*, Thermodynamics and Kinetics of Spontaneous Generation, 186 Nature 693, 693 (1960)(concentration between 10-27 and 10-12 molar, ignoring destruction by cross-reactions). Accord, Dose*, _____ _____, in The Origin of Life and Evolutionary Biochemistry ___, 69 (K. Dose* et al. eds. 1979) (maximum concentration 10-7 molar, ignoring ultraviolet destruction in atmosphere and destruction by cross-reaction); Nissenbaum*, _____, 7 Origins of Life _____, 413 (1976) (maximum concentration 10-7 molar, ignoring ultraviolet destruction in atmosphere or ocean).

that the primordial soup instead was evaporation pools, rather than the ocean. However, such pools would have brought about evaporation of such essential compounds as aldehydes and hydrogen cyanide;546/ and there is no geological evidence for the existence of such pools.547/

Summary. The primordial soup that is required for biochemical evolution is also a matter of speculation rather than of scientific evidence, and much scientific evidence contradicts the possibility of such a primordial soup of organic compounds. This constitutes a material factual issue about the noncompelling status of evolution and

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546. Horowitz* & Hubbard*, _____, 8 Ann. Review of Genetics 393 (1974); Sanchez*, Ferris * & Orgel*, _____, 153 Science 72 (1966).

547. Dose*, _____, in The Origin of Life and Evolutionary Biochemistry _____, 75 (K. Dose* et al eds. 1979).

the scientific nature of creation-science.

(c) Problems with Various Evolutionary Stages of Biochemical Evolution. Biochemical evolution involves the stages of evolution of amino acids, evolution of proteins, evolution of protocells, evolution of the genetic coding system, and evolution of the first living cell, as discussed above. It also requires evolution of sugars, enzymes, and lipids. The following paragraphs discuss the serious problems with each of the alleged stages of biochemical evolution: (i) of amino acids, (ii) of proteins in general, (iii) of sugars, (iv) of enzymatic activity, (v) of lipids, (vi) of protocells, (vii) of the genetic coding system, and (viii) of a living cell. It is very important to note that (ix) natural selection is inapplicable to these stages. Overall,

> Those who work on the origin of life must necessarily make bricks without very much straw, which goes a long way

> to explain why this field of study is so often regarded with deep suspicion. Speculation is bound to be rife, and it has also frequently been wild. Some attempts to account for the origin of life on the Earth, however ingenious, have shared much with imaginative literature and little with theoretical inference of the kind which can be confronted with observational evidence of some kind or another.548/

(i) Evolution of Amino Acids. Even the first step, the evolution of a sufficient quantity of amino acids (of which proteins are made), poses serious problems. As discussed above, cross-reactions would have destroyed most amino acids, radiation would have destroyed 97% of the surviving amino acids in the atmosphere and most in the primordial soup, and dilution would have prevented significant formation of proteins.

(ii) Evolution of Proteins. Assuming a sufficient supply of amino acids, many

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548. _____*, _____, 216 Nature 635 (1967).

further problems realistically would have prevented the evolution of biologically meaningful proteins from those amino acids. First, cross-reactions would have occurred between amino acids and sugars, aldehydes, amines, ketones, and carboxylic acids, preventing the amino acids from being available to form proteins.549/ Similarly, cross-reactions would have occurred between any proteins and formaldehyde to form cross-linkages between proteins.550/ Second, any proteins and many amino acids formed in the primordial soup generally would be destroyed by hydrolysis through reaction with the water in the soup, and this would occur in a matter of days or months.551/ Third, the

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549. Nissenbaum*, _____, 7 Origins of Life 413 (1976).

550. J. Walker*, Formaldehyde 404 (3d ed. 1964).

551. Dose*, _____, in The Origin of Life and Evolutionary Biochemistry 69 (K. Dose* et al. eds. 1979);

formation of proteins would be generally prevented by the dilution of the primordial soup, so that "it is now generally accepted that the concentration of the 'soup' was probably too small for efficient synthesis, particularly of biopolymers."552/ Fourth, any proteins formed would generally be destroyed by the temperatures required to synthesize amino acid intermediates.553/ Fifth,

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Amino Acids, in Encyclopedia of Science and Technology Vol. 1, 411-424 (1982).

552. Nissenbaum*, _____, Journal of Molecular Evolution 259 (19___). Accord, Dose*, _____, in The Origin of Life and Evolutionary Biochemistry, 74 (K. Dose et al. ed. 1979).

553. Sagan*, Simulated Natural Experiments, in The Origins of Prebiological Systems and of Their Molecular Matrices 374-75 (S. Fox* ed. 1965) ("The temperatures required to synthesize the amino acid intermediates rapidly pyrolyze amino acids, depolymerize polypeptides, and degrade microspheres. I would like to see an order of magnitude calculation in which a probability is assigned to each scene of the scenario, and a total polypeptide abundance over geological time derived. It seems to me that this abundance will be much less than the large concentration of polypeptides in

most polypeptides formed would be biologically useless because they would generally include nonproteinous amino acids (which are four times as numerous as proteinous amino acids). Sixth, proteins would not be biologically useful unless they were made solely of L-amino acids (half of amino acids would be D-amino acids), even though there would be an equal probability for each constituent amino acid in an early protein to be a D-amino acid.554/ Finally,

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the primitive seas apparently required for the origin of life, Strecker synthesis of amino acids seems much more likely in primitive times, but the problem of the large-scale production of polypeptides remains, I believe, unsolved.").

554. Williams* & Smith*, A Critical Evaluation of the Application of Amino Acid Racemization to Geochronology and Geothermometry, 8 Origins of Life 91, 91 (1977) ("There is certainly a unique relationship between optical activity and life. Virtually all proteins contain exclusively the L-enantiomers of the amino acids while natural sugars are of the D-configuration. Many chemists would agree with the statement made at the First International Symposium

and most important, virtually all protein-like products would be biologically nonmeaningful, because their amino acid building blocks would not be in a biologically meaningful sequence.555/

(iii) Evolution of Sugars. Sugars would have to evolve before the genetic coding system could evolve, because sugars are an integral part of nucleic acids (DNA and RNA etc., which are elements of the genetic coding system). Although sugars are often postulated to have arisen from condensation of formaldehyde, the evolution of sugars also has serious problems that cause Reid* and Orgel* to conclude that "[w]e do not believe that the formose reac-

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on the Origin of Life on Earth by Terent'ev and Klabunovskii (1957), 'we will start from the assumption that life cannot and never could exist without molecular dissymmetry.'"). Accord, notes 496-98 supra.

555. Section 2[b](1)(b) supra.

tion . . . is a plausible model for the prebiotic accumulation of sugars."556/ First, much of the formaldehyde in the atmosphere or ocean would have been destroyed. 557/ Seccond, sugars generally would have been destroyed by cross-reactions with amino acids.558/ Third, the concentration of sugars in the primordial soup would have been far too small, based on studies of their stability.559/ Fourth, the genetic coding system today uses only D-sugars, and yet L-sugars would have been equal in quantity.560/

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556. Reid* & Orgel*, Synthesis of Sugars in Potentially Prebiotic Conditions, 216 Nature 455, 455 (1967).

557. Abelson*, _____, 55 Proc. of National Academy of Science 1365 (1966); Hulett*, _____, 24 Journal of Theoretical Biology 56 (1969).

558. S. Fox* & K. Dose*, Molecular Evolution and the Origin of Life 106 (1972).

559. Abelson*, _____, 55 Proc. of National Academy of Science 1365 (1966).

560. Williams* & S mith*, A Critical

(iv) Evolution of Enzymes. Enzymes (which are proteins with catalytic ability to accelerate chemical reactions) are also essential to life but also present serious problems. First, as many scientists have recognized, "[e]nzymes possess exceptional activity and specificity of catalytic action" that "cannot arise accidentally in a simple solution of organic compounds."561/ Even if enzymes with weak catalyic ability would work, their evolution is still implausible.562/ Second, enzymes are not able to replicate themselves, and they would have to be continually produced by biochem-

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Evaluation of the Application of Amino Acid Racemization to Geochronology and Geothermometry, 8 origins of Life 91, 91 (1977); C. Patterson*, Evolution 157 (1978) (he interprets this evidence that life originated only once).

561. A. Oparin*, Genesis and Evolutionary Development of Life 136 (1968).

562. M. Dixon* & M. Webb*, Enzymes 665 (2d ed. 1964).

ical evolution until an early organism could produce them.

(v) Evolution of Lipids. Lipids (or fatty acids) are essential to the cell membrane. Miller* and Orgel*, two leading researchers, have concluded that "[n]o satisfactory synthesis of fatty acids is presently available."563/ Lipids would rapidly have been destroyed by cross-reactions that formed insoluble salts with magnesium and calcium ions in a primordial soup.564/

(vi) Evolution of Protocells. Proto-

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563. S. Miller* & L. Orgel*, The Origins of Life on the Earth 98 (1974) ("No satisfactory synthesis of fatty acids is at present available. The action of electric discharges on methane and water gives fairly good yields of acetic and propionic acids , but only small yields of the higher fatty acids. Furthermore, the small quantities of higher fatty acids that are found are highly branched."). They do not find satisfactory Fischer-Tropsch reaction.

564. Abelson*, _____, 55 Proc. of the National Academy of Science 1365 (1966).

cells are the imagined link between complex proteins (and other substances) and a first living cell; various models of protocell evolution are discussed below.565/

(vii) Evolution of the Genetic Code. The genetic code is essential for replication of a living organism, yet its evolution is also plagued by serious problems, as Dickerson* recognizes:

> The evolution of the genetic machinery is the step for which there are no laboratory models hence we can speculate endlessly, unfettered by inconvenient facts.566/

First, although nonrandom segments of DNA and RNA have been formed, life requires not just nonrandom strands but biologically relevant information in biologically meaningful sequences of DNA and RNA.567/

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565. Section 2[b](2)(d)(iv) infra.

566. Dickerson*, _____, 239 Scientific American 62 (1978). Accord, Orgel*, Darwinism at the Very Beginning of Life, 94 New Scientist 151 (1982).

567. T. Dobzhansky*, F. Ayala*, G.

Second, the origin of the genetic code cannot be discussed without a discussion of the origin of the complicated mechanism of protein synthesis.568/ Third, the genetic code is meaningless without machinery to translate it in order to produce a new organism, but that machinery "consists of at least fifty macromolecular components which are themselves coded in DNA, according to Monod*.569/ As Popper* has said, "[t]his constitutes a really baffling circle because the code cannot be translated except by using certain products of its translation."570/ Fourth, any nucleotides (build-

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Stebbins* & J. Valentine*, Evolution 21-23 (1977).

568. Crick*, _____, 38 Journal of Molecular Biology 367 (1968); Woese*, _____, in Progress in Molecular and Subcellular Biology ____ (Hahn, Springer, & Wallenfels, eds. 1969).

569. J. Monod*, Chance and Necessity 143 (1971).

570. Popper*, _____,

ing blocks of DNA and RNA) that were formed would be vulnerable to destructive cross-reactions with formaldehyde.571/

(viii) Evolution of the Living Cell. The most simple living cell is vastly different from the proteins or macromolecules from which it allegedly evolved:

> The macromolecule-to-cell transition is a jump of fantastic dimensions . . .. The available facts do not provide a basis for postulating that cells arose on this planet.572/

This is because even the most simple cell involves an extremely complex genetic coding

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in Studies in the Philosophy of Biology __, 259 (1974). Accord, E. Ambrose*, The Nature and Origin of the Biological World 135 (1982).

571. J. Walker*, Formaldehyde 398 (3d ed. ACS Monograph No. 159 1964).

572. D. Green* & R. Goldberger*, Molecular Insights into the Living Process 407 (1967). Accord, Kenyon* & Nissenbaum*, _____, ____ Journal of Molecular Evolution ___, 246 (19___) ("it must be emphasized that a very large gap separates the most complex model systems from the simplest contemporary living cells").

system of DNA, messenger RNA, transfer RNA, chains and cycles of enzymes, other proteins, metabolic pathways, a cell membrane with distinct properties, and other incredibly complex components.

(ix) Inapplicability of Natural Selection. It is important to note that natural selection, which is an important part of biological evolution, does not apply to biochemical evolution and consequently cannot be relied on to assist biochemical evolution. This has been recognized by the late Professor Dobzhansky*, a leading evolutionist scientist:

> Natural selection is differential reproduction, organism perpetuation. In order to have natural selection, you have to have self-reproduction or self-replication and at least two distinct self-replicating units or entities . . .. Prebiological, natural selection is a contradiction in terms.573/

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573. Dobzhansky*, _____, in The Origins of Prebiological Systems___, 310 (S. Fox ed. 1965).

Other researchers have agreed.574/

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574. Simon* states:

> For example, a number of people have tried to extend the biological notion of natural selection to account for the building up of the first self-replicating system, forgetting that the Darwinian conception already presupposes the existence of a mutable, self-replicating system.

M. Simon*, The Matter of Life 166 (1971).

Blum* concurs:

> The term natural selection is sometimes loosely applied to evolution in physical systems, and perhaps a basic difference between chemical evolution and evolution of living organisms should be pointed out. . . . This kind of chemical evolution, rigidly governed by energetics and kinetics, we may think of as going on before the advent of life; but this is very different from mutation and natural selection in living systems. In the strictly chemical system molecules lack the property of self reproduction--the activated molecule does not perpetuate itself by reproducing its kind, but rapidly returns to a normal level if it does not undergo reaction. Reproduction of stable patterns and stable variants of these patterns is essential for evolution by natural selection. This was impossible before the advent of systems that could synthesize molecules having the stability and kind of variability associated with proteins and nucleic acids.

Summary. There are serious problems with each alleged stage of biochemical evolution of the first life. This raises a material factual issue about the noncompelling status of evolution and the scientific nature of creation-science.

(d) Problems with Extrapolating Laboratory Experiments over to Biochemical Evolution. Carl Sagan*, an ACLU witness, has acknowledged:

> The production of organic molecules for the origin of life is not at all the same as the origin of life.575/

Too often the implication is given that

H. Blum*, Time's Arrow and Evolution 157 (3d ed. 1968). See also Yockey*, Self Organization Origin of Life Scenarios and Information Theory, 91 Journal of Theoretical Biology 13, 13 (1981). The information content of amino acid secuences cannot increase until a genetic code with an adaptor function has appeared. Nothing which even vaguely resembles a code exists in the physico-chemical world.").

575. Sagan*, _____, in Exobiology 471 (C. Ponnamperuma* ed. 1972).

scientists have "created life in the test tube," when in fact the actual experiments have been limited in scope and often extremely improbable in assumptions. The following paragraphs describe experiments (i) synthesizing amino acids, (ii) synthesizing alleged proteins, (iii) synthesizing components of the genetic coding system, and (iv) hypothesizing protocells. "The best that one can say about these models is that some of the processes which they postulate might conceivably have happened, but not that they did actually happen in the real history of the earth," as Dobzhansky* notes.576/ In general, the significance of

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576. T. Dobzhansky*, The Biology of Ultimate Concern 46, 46 (1967). Accord, Hull*, Thermodynamics and Kinetics of Spontaneous Generation, 186 Nature 693, 694 (1960) ("But the fact that a chemist can carry out an organic synthesis in the laboratory does not prove that the same synthesis will occur in the atmosphere or open sea without the chemist.").

these experiments is extremely limited because groups of chemicals that react when isolated from the primordial soup will not so react when they are in the presence of diverse chemicals in the primordial soup, but instead will frequently enter into destructive cross-reactions.577/ Further, interpretations of these experiments frequently ignore illegitimate forms of investigator involvement:

> These experiments . . . claim abiotic synthesis for what has in fact been produced and designed by highly intelligent and very much biotic man.578/

(i) Experiments Synthesizing Amino Acids. Stanley Miller* conducted an experiment in which he synthesized amino acids by

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577. L. Dillon*, The Genetic Mechanism and the Origin of Life _____ (1978).

578. J. Brooks* & G. Shaw*, Origin and Development of Living Systems 212 (1973). Accord, Orgel* & Lohrmann*, _____, 7 Accounts of Chemistry Research 368 (1974).

circulating a mixture of methane, ammonia, hydrogen, and other gases past an electric spark. This experiment has limited implications for biochemical evolution because of critical but unrealistic conditions. In general, one researcher has commented that "an experiment designed to produce nucleic acids produces little else."579/ First, the experiment used a special trap for "selectively removing the product [amino acids]" immediately after their formation, because the very energy sources that generated the

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579. Keosian*, _____, in The Origin of Life and Evolutionary Biochemistry ____, 221 (K. Dose* et al. eds. 1974). Clemmey* & Badham* similarly note:

> However, the achievements of Miller (1955) and others (for example, papers in Buvet and Ponnamperuma, 1978), while being triumphs for experimental biochemistry, may have little relevance concerning the origin of life on Earth or the composition of the early atmosphere.

Clemmey* & Badham*, Oxygen in the Precambrian Atmosphere: An Evaluation of the Geological Evidence, 10 Geology 141, 141 (1982).

amino acids would otherwise destroy them.580/ Sagan acknowledges the critical nature of the trap in such experiments:

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580. Hull*, Thermodynamics and Kinetics of Spontaneous Generation 186 Nature 693, 694 (1960) ("Miller and others . . . have synthesized organic compounds with electrical discharges or ultraviolet light in the laboratory. They have merely used the well-known principle of increasing the yield of a reaction by selectively removing the product from the reacting mixture. But the fact that a chemist can carry out an organic synthesis in the laboratory does not prove that the same synthesis will occur in the atmosphere or open sea without the chemist. The second law of thermodynamics applies not only to inorganic gases in the atmosphere, but also to organic compounds in the ocean.'). Accord, Harada* & Fox*, _____, in The Origins of Prebiological Systems and of Their Molecular Matrices 187 (_____, eds. 1965); Miller*, _____, 77 Journal of American Chemistry Society 2351 (1955); Groth* & Weyssenhoff*, _____, Naturwiss 510 (19__); Ponnamperuma* & Flores*, Abstract American Chemistry Society, 152nd Meeting _____ (19___); Dodonova* & Terenin* & Sidorova, _____, 6 Biophysics 14 (19___); Khare* & Sagan*, _____. in Molecules in the Galactic Environment 399 (_____ eds. 19___); Hong*, Hong* & Becker*, Science 984 (19___).

> The problem we're discussing is a very general one. We use energy sources to make organic molecules. It is found that the same energy sources can destroy these organic molecules. The organic chemist has an understandable preference for removing the reaction products from the energy source before they are destroyed. But when we talk of the origin of life I think we should not neglect the fact that degradation occurs as well as synthesis, and that the course of reaction may be different if the products are not preferentially removed. In reconstructing the origin of life, we have to imagine reasonable scenarios which somehow avoid this difficulty.581/

Second, the experiments frequently use short wavelength ultraviolet light but exclude the long wavelength ultraviolet light that presumably would have been even more abundant, because the long wavelength is very effective in destroying any amino acids formed.582/ As Miller* and Orgel* acknow-

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581. Sagan*, _____, in The Origins of Prebiological Systems and of Their Molecular Matrices, 195-6 (S. Fox* ed. 1965).

582. On the destructiveness of long wavelength ultraviolet, see Hulett*, _____

ledge, "[m]any interesting scraps of information are available, but no correct pathways have yet been discovered."583/

(ii) Experiments Synthesizing Proteins. A major experiment by Sidney Fox* synthesized "proteinoids" (claimed to resemble

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_____, 24 Journal of Theoretical Biology 56 (1969); J. Pringle*, New Biology 54 (1954); Sagan*, _____ 15 Rad. Res. 174 (1961); Miller*, Urey* & Oro*, _____, 9 Journal of Molecular Evolution 59 (1976). On its exclusion in experiments, see Groth* & Weyssenhoff*, _____, 44 Naturwiss. 510 (1959); Ponnamperuma* & Flores*, _____, Abstract American Chemistry Society, 152nd Meeting (19___); Terenin*, _____, in The Origin of Life on the Earth _____ (A. Oparin* ed. 1959); Dodonova* & Sidarova*, _____, 6 Biophysics 14 (1961). Although some experiments assume phytosynthesization through gases filtering out destructive ultraviolet light, such gases would have themselves been broken down by photolysis in about 10,000 years. Ferris* & Nicodem*, _____ in The Origin of Life and Evolutionary Biochemistry 113 (K. Dose*, S. Fox*, G. Deborin* & T. Pavlosvskaya eds. 1974).

583. S. Miller* & L. Orgel*, The Origins of Life on the Earth 148 (19___).

shorter proteins). However, such experiments have not produced biologically meaningful proteins584/ for at least four reasons. First, these proteinoids have scarce resemblance to natural peptidic material" because they generally have nonbiological forms of peptide bonds.585/ Second, these proteinoids appear to be largely random sequences of amino acids very different from biological proteins, as researchers Miller* and Orgel* have noted:

> The degree of nonrandomness in thermal polypeptides so far demonstrated is minute compared to nonrandomness of proteins. It is deceptive, then, to suggest that thermal polypeptides are similar to proteins in their nonrandomness.586/

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584. L. Dillon*, The Genetic Mechanism and the Origin of Life _____ (1978).

585. Temussi*, Paolillo*, Ferrera*, Benedetti* & Andini*, _____, 7 Journal of Molecular Evolution 105 (1976).

586. S. Miller* & L. Orgel*, The Origins of Life on Earth 144 (1974). Accord, E. Ambrose*, The Nature and Origin of the Biological World 143 (1982). The addition

Third, Fox's* proteinoids and other experimental products include generally equal numbers of L- and D-amino acids, whereas biologically meaningful proteins must contain all L-amino acids.587/

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of energy "cannot increase the probability of a particular sequence being generated." Id.

587. Stansfield* notes that about the experiments:

> All proteins today consist entirely of amino acids that rotate planepolarized light to the left (L forms). However, none of the prebiotic compounds synthesized in the laboratory under primitive earth conditions have been reported to have optical activity because of racemization (a mixture of D and L forms).

W. Stansfield*, The Science of Evolution 57 (1977).

> All proteins today consist entirely of amino acids that rotate planepoloarized light to the left (L-forms). However, none of the prebiotic compounds synthesized in the laboratory under primitive earth conditions have been reported to have optical activity because of racemization (a mixture of D and L forms).

Accord, Williams* & Smith*, A Critical Evaluation of the Application of Amino Acid Racemization to Geochronology and Geothermometry, 8 Origins of Life 91, 91 (1977);

Fourth, the geological conditions in the Fox* experiments are very unlikely.588/ Fox's* microspheres are discussed in the paragraph after next.

(iii) Experiments Involving Genetic Coding System. The genetic coding system of DNA and RNA requires specific sequences of nucleotides (the building units). Probability studies effectively rule out the possibility of workable sequences evolving, as discussed below.589/ The sugars that form part of the nucleotides must be L-sugars, whereas experiments produce roughly equal quantities of L-and D-sugars.590/

C. Folsome*, The Origin of Life 87 (1979); L. Dil on*, The Genetic Mechanism and the Origin of Life (1978).

588. S. Miller* & H. Urey*, The Origins of Life on the Earth 145 (1974); Kenyon* & Nissenbaum*, _____, 7 Journal of Molecular Evolution 245, 246 (1976).

589. Section 2[b](2)(e) infra.

590. Williams* & Smith*, A Critical Evaluation of the Application of Amino Acid

(iv) Experiments Proposing Protocell Models. The protocell is the form prior to the first living cell that biochemical evolutionists postulate. First, these models are separated by "a very large gap" from the least complex living cell, and involve numerous problems:

> Although each of the proposed model systems exhibits some rudimentary properties of chemical evolutionary interest, it must be emphasized that a very large gap separates the most complex model systems from the simplest contemporary living cells. Moreover, the geochemical plausibility of many of these "protocell" models is open to serious question (Nissenbaum et al. 1976).591/

Racemization to Geochronology and Geothermometry, 8 origins of Life 91, 91 (1977); C. Patterson*, Evolution 157 (1978) (he interprets this evidence that life originated only once).

591. Kenyon* & Nissenbaum*, _____, 7 Journal of Molecular Evolution 245, 246 (1976). Hoyle similarly observes:

> However, the next step--the coming together of subunits into larger organized molecules with the capacity to reproduce themselves--has not occurred in the laboratory flask. . . . As for

Second, these model protocells are not able to replicate themselves, yet that is a complex process essential to the evolution of life.592/ Third, these model protocells are about as uncell-like as soap bubbles, and are very unstable because they lack the internal structure of cells:

> The pseudo-cellular models like clay, soap bubbles, or any other inanimate objects have neither the mechanism nor the potential of becoming anything beyond what they are. . . . But the most serious fault of models from particles held together by ionic forces is that they would have been continually periled with dissolution. Coacervates are notoriously unstable and microspheres exist only in saturated solutions. Their existence in Archaen lakes or oceans would have been short-lived.593/

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the appearance of complex biochemicals in the primordial soup, there is an enormous gap in the evidence, one that seems unlikely ever to be bridged. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 20-21 (1983).

592. Fakhari*, van Roode* & Orgel*, Synthesis of Oligoguanylates on Oligocytidylate Templates, 17 Journal of Molecular Evolution 295, 302 (1981).

593. W. Day*, Genesis of the Planet

Fourth, these protocell models require an impossibly high concentration of their components--which Folsome* calls the "concentration gap."594/

The coacervate model was proposed by Oparin*, based on the outward resemblance of coacervates (protein macromolecules in the form of tiny droplets) to actual cells. However, "the leap from morphology to function is fraught with danger," and the coacervates are totally unlike actual cells because they lack structure, lack a metabo-

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Earth 320 (1979). Accord, C. Ponnamperuma, Origins of Life 102 (1972) ("There is an extensive literature dealing with the accumulation of various solutions of organic matter and the resulting cell-like structures. However, the leap from morphology to function is fraught with danger, especially when we consider entities of several billion years ago.").

594. C. Folsome*, The Origin of Life 84-85 (1979) ("Hypothetically, there are ways to circumvent the concentration gap, but all appear to be more wishful thinking than plausible facets of reality.").

lic system, and are unstable and readily dissolved.595/ Moreover, they require complex polymers for their formation.596/ Alternatively, the proteinoid microsphere model has been proposed by Fox* as an extension of his work with proteinoid synthesis. However, the microspheres' membranes "are not 'single biologicallike' membranes since they do not contain lipids or carry out any of the functions of biological membranes," according to Miller* and Orgel*.597/ Also, the microspheres lack metabolic processes

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595. C. Ponnamperuma, Origins of Life 102 (1972); J. Bernal*, J. Weidenfeld* & Nicolson*, The Origin of Life 168 (1967); Fox*, Harada*, Krampitz* & Mueller*, _____, Chemical & Engineering News 80 (June 22, 1970); S. Fox* & K. Dose*, Molecular Evolution and The Origin of Life 220 (19__).

596. J. Bernal*, D. Weidenfeld* & Nicholson*, The Origin of Life 168 (1967); C. Folsome*, The Origin of Life, 83 (1979).

597. S. Miller* & L. Orgel*, The Origins of Life on the Earth 144 (1974); C. Folsome*, The Origin of Life 87 (1979).

or replication processes, as Oparin* points out:

> Fox's microspheres, since they are obtained thermally, do not represent very promising results from this view (i.e., evolving to include metabolic processes). Their structure is static. This . . . creates difficulties when it comes to converting them into dynamic systems which could be used for modeling the evolution of metabolism.598/

They involve merely the "formation of unnatural peptide bonds."599/ These proteinoid microspheres require unlikely geological conditions.600/

Summary. The laboratory experiments on the origin of life have not "created life in the test tube," have only taken the limited step of synthesizing some basic units

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598. A. Oparin*, Genesis and Evolutionary Development of Life 105 (19___).

599. Temussi*, _____, 8 Journal of Molecular Evolution 305 (1976).

600. Miller* & Urey*, _____, 130 Science 245 (1959); S. Miller* & L. Orgel*, The Origins of Life on the Earth 145 (1974).

necessary for life, have serious problems with unrealistic assumptions and conditions, and in no way prove that life actually evolved by such mechanisms. This poses a material factual issue about the noncompelling nature of evolution and the scientific nature of creation-science.

(e) Problems with Information Content and Improbability of Biochemical Evolution. Many researchers have concluded that the vast information content of the least complex life, and the vast improbability of evolution of such life, realistically rule out biochemical evolution. The most that biochemical evolution could have accomplished in several billion years is formation of a single short protein according to Yockey*, and a single pair of genes under the analysis of Eden*.603/ The probability

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603. Yockey*, A Calculation of the Probability of Spontanecus Biogenesis by

of a single-celled bacteria evolving is only 1 chance in 102,000,000 according to Ambrose*; of the least complex single-celled organism is only 1 chance in 1078,436 as calculated by Hadd* and merely 1 chance in 10450 according to Golay*; and of human enzymes is only 1 chance in 1040,000 under the figures of Hoyle and Wickramasinghe.604/

Information Theory, 67 Journal of Theoretical Biology 377, 377 (1977). Cf. Section 2[b](1)(b) infra (probability argument); Eden*, Inadequacies of Neo-Darwinian Evolution as a Scientific Theory, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution _____, 9 (P. Moorehead* & M. Kaplan* eds. 1982).

604. E. Ambrose*, The Nature and Origin of the Biological World 135 (1982); Hadd*, _____, _____, 31 (19___); Golay*, Reflections of a Communications Engineer, 33 Analytical Chemistry 23 (June 1961); Prigogine*, Nicolis* & Babloyants*, Thermodynamics of Evolution, Physics Today, Nov. 1972, at 23, _____ ("The probability that at ordinary temperatures a macroscopic number of molecules is assembled to give rise to the highly ordered structures and to the coordinated functions characterizing living organisms is vanishingly small. The idea of spontaneous genesis of life in its present form is therefore

The probability of evolving a simple protein is merely 1 chance in 10130 according to Lovel*; of a cytochrome c protein is only 1 chance in 1094 under the calculations of Yockey*; and of a DNA chain for producing a simple protein is merely 1 chance in 10600 according to Salisbury*.605/ Each of these

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highly improbable even on the scale of the billions of years during which prebiotic evolution occurred."). Accord, Keosian*, Life's Beginnings--Origin or Evolution?, in Cosmochemical Evolution and the Origins of Life, _____, 291 (J. Oró et al. eds. 1974) ("[T]he simplest heterotrophic cell is an intricate structual and metabolic unit of harmoniously coordinated parts and chemical pathways. Its spontaneous assembly out of the environment, granting the unlikely simultaneous presence of all the parts, is not a believable possibility."); F. Hoyle & N. Wickramasinghe, Evolution from Space 24 (1981).

605. E. Ambrose*, The Nature and Origin of the Biological World 135 (1982); Yockey*, A Calculation of the Probability of Spontaneous Biogenesis by Information Theory, 67 Journal of Theoretical Biology 377, 387 (1977) ("The number of sequences of cytochrome c is now 7.25 x 1060, the number of sequences for 101 sites, is 3.4 x 10154. Therefore the probability of selecting a member of the cytochrome c family with

probabilities is far less than the level of statistical impossibility in the universe,

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the same optical isomer in a given set of 101 rolls of the icosahedral dice is 2.15 x 10-94."); Salisbury*, Doubts about the Modern Synthetic Theory of Evolution, 33 American Biology Teacher 335, 336 (1971) ("A medium protein might include about 300 amino acids. The DNA gene controlling this would have about 1,000 nucleotides in its chain. Since there are four kinds of nucleotides in a DNA chain, one consisting of 1,000 links could exist in 41,000 different forms. Using a little algebra (logarithms), we can see that 41,000 = 10600. Ten multipled by itself 600 times gives the figure 1 following by 600 zeros! . . . [I]magine how many universes it would take to accommodate 10600 DNA chains!"). Accord, Leslie*, Cosmology, Probabilty, and the Need to Explain Life, in Scientific Explanation and Understanding 53, 64-65 (N. Rescher* ed. 1983) ("We can point also to the 'improbable' left-handedness of almost all the amino acids found in life on earth, when left-handed and right-handed varieties are equally easily made in the laboratory; to the "improbable" DNA molecule, a million times longer than it is wide; to estimates that the information encoded in a single human chromosome is equivalent to several thousand volumes of small print; to a large mammal's thousand trillion cells of about a thousand different varieties, and to how it took Evolution far longer to invent the cell, so naively called 'simple,' than to make the leap to mammals; and so on.").

and is far less than the ratio of 1 atom to all atoms in the universe (1 to 1080).906/ A good summary of the information content and probability problems towering over biochemical evolution is given by Hoyle:

> [T]he combinatorial arrangement of not even one among the many thousands of biopolymers on which life depends could have been arrived at by natural processes here on the Earth. Astronomers will have a little difficulty at understanding this because they will be assured by biologists that it is not so, the biologists having been assured in their turn by others that it is not so. The "others" are a group of persons who believe, quite openly, in mathematical miracles.606a

Summary. Biochemical evolution is at best an insufficient explanation and is in fact highly improbable. This offers a ma-

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606. Lafont*, quoting G. Salet*, Chance and Certainty: Evolution in the Light of Modern Biology (1972). Accord, E. Borel*, Probabilities and Life 28 (1963); E. Borel*, Elements of the Theory of Probability 57 (1965).

606a. Hoyle, The Big Bang in Astronomy, 91 New Scientist 521, 526 (1981).

terial factual issue about the noncompelling status of evolution and the scientific nature of creation-science.

Conclusion. Biochemical evolution is fraught with problems such as the necessity of an unrealistic atmosphere, the necessity of an unrealistic primordial soup, the necessity of unrealistic and improbable evolutionary stages, the unrealistic nature of the experiments performed, and the very high improbability calculated by information scientists and mathematicians. Instead, as Yockey* concludes:

> The Darwin-Oparin-Haldane "warm little pond" scenario for biogenesis is examined by using information theory to calculate the probability that an informational biomolecule of reasonable biochemical specificity, long enough to provide a genome for the "protobiont", could have appeared in 109 years in the primitive soup. . . . It is concluded that belief in currently accepted scenarios of spontaneous biogenesis is based on faith, contrary to conventional wisdom.607/

This "faith" is not warranted by the scien-

tific evidence, but instead results from a general bias against creation-science, as Wald* acknowledges:

> The reasonable view was to believe in spontaneous generation; the only alternative, to believe in a single, primary act of supernatural creation. There is no third position. For this reason many scientists a century ago chose to regard the belief in spontaneous generation as a "philosophical necessity." It is a symptom of the philosophical poverty of our time that this necessity is no longer appreciated. Most modern biologists, having reviewed with satisfaction the downfall of the spontaneous generation hypothesis, yet unwilling to accept the alternative belief in special creation, are left with nothing.
>
> I think a scientist has no choice but to approach the origin of life through a hypothesis of spontaneous generation.608/

Thus, biochemical evolution is not compellingly established. These are material factual issues.

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607. Yockey*, A Calculation of the Probability of Spontaneous Biogenesis by Information Theory, 67 Journal of Theoretical Biology 377, 377 (1977).

608. Wald*, The Origin of Life, Scientific American, August, 1954, at 46, 46; Section 2[d](6) infra.

(3) Difference from the McLean Case concerning Biochemical Creation and Biochemical Evolution

The incorrectness of the McLean opinion's conclusions that "creation-science is not science" and that the "proof in support of creation-science consisted almost entirely of efforts to discredit the theory of evolution"609/ is manifested in the affirmative scientific evidences for biochemical creation that are summarized above. The assertion in that opinion that "the scientific community does not consider origins of life a part of evolutionary theory"610/ is shown to be very mistaken by the extensive authority in footnotes 507-509: the scientific community generally regards biochemical evolution as an important and in-

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609. McLean v. Arkansas Board of Education, 529 F. Supp. 1255, 1270, 1272 (E.D. Ark. 1982).

610. Id. at 1266.

tegral part of evolution. The affirmative scientific evidence, which is described here and will be summarized by the State's expert witnesses, is very different from the arguments brought before the Arkansas court. The "only source of this information" is not "ultimately contained in the book of Genesis"611/--which does not mention information content, probability, isomers, chemical tendencies, and thermodynamics--but in science.

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611. Id. at 1272.

c. Material Factual Issues about the Scientific Nature of Creation-Science and Evolution concerning the Origin of the Universe

Definitions. The origin of the universe is the final aspect of evolution and creation-science. Evolution includes cosmic evolution (of the universe),614/ and the terms "cosmic evolution" and "stellar evolution" are generally accepted terms.615/

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614. Extensive documentation is given at the beginning of Section 2[c](2) and in note ____ infra.

615. Extensive documentation is given at the beginning of Section 2[c](2) and in note ____ infra.

*Note: Scientists cited in this Section (c), unless otherwise indicated, are not creationists, and their quoted statements are not intended as endorsements of creation-science. However, their quoted statements are acknowledging data that creationist scientists interpret as supporting creation-science better than evolution-science.

Cosmic evolution describes the origin of the universe as being by transformation through the "big bang--clusters of galaxies, galaxies, stars, planets, and, eventually, life . . .," in the words of Carl Sagan*.616/

Cosmic creation describes the origin of the universe as being through abrupt appearance in complex form, as indicated by empirical evidence and related scientific interpretations.

Summary. This empirical evidence for cosmic creation is summarized in Section (1), and the noncompelling status of cosmic evolution is outlined in Section (2), while the errors of the McLean decision about these explanations are discussed in Section (3) below.

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616. C. Sagan*, Cosmos 247 (1980). Accord, Section 2[c](2)(a) infra.

(1) Empirical Evidence for Cosmic Creation (of the Universe)

Overview. Empirical evidence for cosmic creation (of the universe) includes at least five arguments:

(a) Thermodynamics argument, (b) Radiohalos argument, (c) Information content argument, (d) Heterogeneity argument, and (e) Galaxy and star formation argument.

In summary, (a) the thermodynamics argument is based on the laws of thermodynamics requiring a beginning for matter and energy and precluding an eternal existence of matter and energy. (b) The radiohalos argument is based on the presence of polonium halos in the earth's crust, which could have formed only if the earth appeared abruptly in a cool rather than molten form, in the absence of evidence of uranium having been present. (c) The information content argument concerns the vast information

content of the universe, with predictable and orderly motion of galactic clusters, galaxies, stars, our solar system, and comets. (d) The heterogeneity argument is based on the significantly uneven distribution or lumpiness of the universe, rather than the even distribution that the big bang hypothesis and evolutionary process would be expected to yield over time. (e) The galaxy and star formation argument involves the condensation of galactic clusters, galaxies, and stars. These evidences are discussed in the following Sections.

These affirmative evidences for cosmic creation are not all newly formulated; a couple were articulated by Sir Isaac Newton nearly 300 years ago, and a couple more were advocated by the great creationist scientists Faraday, Maxwell, and Kelvin about 100 years ago, as discussed below.617/ Moreover, they indeed are affirmative argu-

ments for creation-science, as Lipson* (a British physicist who describes himself as an Atheist) concludes on considering some of this evidence:

> I think, however, that we must go further than this and admit that the only acceptable explanation is creation. I know that this is anathema to physicists, as indeed it is to me, but we must not reject a theory that we do not like if the experimental evidence supports it.618/

(a) Thermodynamics Argument for Cosmic Creation. The thermodynamics argument is founded in the first and second laws of thermodynamics, which are the laws of conservation of energy and of entropy. Stansfield*, an evolutionist scientist and professor at California Polytechnic, accurately describes the thermodynamics argument,

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617. E.g., I. Newton, Principia Mathematica (2d ed. 1686, F. Cajori trans. 1960).

618. Lipson*, A Physicist Looks at Evolution, 31 Physics Bulletin 138, 138 (1980).

agrees that it is an affirmative argument for cosmic creation, and agrees that it is in fact correct in his college textbook on evolution:

> Creationists continually refer to the laws of thermodynamics in their arguments against a natural origin for living systems. The First Law of Thermodynamics, sometimes called the Law of Conservation of Energy, states that energy can be transformed from one kind to another, but it can neither be created nor destroyed. Since matter and energy have been shown to be interconvertible, the First Law can be modified to state that neither matter nor energy can be created or destroyed. The Second Law of Thermodynamics states that in converting one form of energy to another, some of it is lost as unusable heat. Entropy is the thermodynamic quality of randomness or disorder within a system. The Second Law therefore implies that as energy is being transformed throughout the universe, entropy is increasing. These Laws argue strongly for a created universe.619/

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619. W. Stansfield*, The Science of Evolution 57 (1977). Accord, G. Van Wylen*, Thermodynamics _____ (1959); see also Hepburn*, Creation in the Context of Scientific Cosmological Theories, 2 Encyclopedia of Philosophy 255, 255 (P. Edwards ed. 1967).

Jastrow*, the founder and director of NASA's Goddard Institute for Space Studies and a professor of astronomy at Columbia, concurs that the laws of thermodynamics require creation of the universe (although he is an Agnostic), and that those laws bar an eternal existence of the universe because of the existence of unused hydrogen:

> This beautiful theory allows the Universe to go on forever in a timeless cycle of death and rebirth, but for one disturbing fact. Fresh hydrogen is the essential ingredient in the plan; it is the main source of the energy by which stars shine, and it is also the source of all the other elements in the Universe. The moment a star is born it begins to consume some of the hydrogen in the Universe, and continues to use up hydrogen until it dies. Once hydrogen has been burned within that star and converted to heavier elements, it can never be restored to its original state. Minute by minute and year by year, as hydrogen is used up in stars,

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Similar definitions of the laws of thermodynamics appear in A. Hobson*, Concepts in Statistical Mechanics 143 (19__); Harvard Project Physics 61, 87 (G. Holton*, F. Rutherford* & F. Watson* eds. 1975).

the supply of this element in the Universe grows smaller.620/

Two frequent replies to the thermodynamics argument are that the universe is eternal or that antimatter exists in the same quantity as matter. However, the universe cannot be eternal, not only because of the existence of unused hydrogen, but because of the "fairly strong evidence that the universe is open" and "probably cannot

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620. R. Jastrow*, God and the Astronomers 109 (1978) (accepting big bang hypothesis as method of creation). Davies* and Hoyle are other physicists who concur. P. Davies*, The Runaway Universe 27 (1980) ("The Universe cannot have existed forever--there must have been a creation.") (same); F. Hoyle, The Nature of the Universe 125 (1950) ("To avoid the issue of creation it would be necessary for all the material of the Universe to be infinitely old, and this it cannot be for a very practical reason. For if this were so, there could be no hydrogen left in the Universe. As I think I demonstrated when I talked about the insides of the stars, hydrogen is being steadily converted into helium throughout the Universe and this conversion is a one-way process--that is to say, hydrogen cannot be produced in any appreciable quantity through

be cyclical" and oscillating.621/ Further,

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the breakdown of the other elements. How comes it then that the Universe consists almost entirely of hydrogen? If matter were infinitely old this would be quite impossible.") (rejecting big bang hypothesis).

621. R. Wald*, Space, Time, and Gravity: The Theory of the Big Bang 61 (1971) ("The best estimate of the mass density of the universe due to matter in galaxies is about 2.5 X 10-31 gm/cu cm. This is some twenty times less than the mass density required for a closed universe. The galactic mass density is, of course, only a lower limit to the true mass density of the universe. We know that there must be at least that much mass density but there might be more that we do not see. However, the most plausible forms in which significant amounts of matter might be hidden--for example, in a tenuous hydrogen gas between the galaxies --seem to be ruled out by a combination of observational and theoretical arguments. Thus, the observation of the mass density of the universe provides fairly strong evidence that the universe is open.); J. Silk*, The Big Bang 324 (1979) ("the universe probably cannot be cyclical, unless we introduce new physical laws that would significantly modify our theory of gravitation"). Accord, Jastrow*, God and the Astronomers 121-122 (1978) ("Yet, although the estimated density of matter in the Universe is greatly increased as a result of this determination, it is still more than ten times too small to bring the expansion of the Universe to a halt. Thus the facts indicate that the Universe will expand forever. We still come

the quantity of antimatter622/ appears to

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across pieces of mass here and there in the Universe, and someday we may find the missing matter, but the consensus at the moment is that it will not be found."); G. Abell*, Exploration of the Universe 648 (4th ed. 1982) ("Such speculation is sometimes referred to as the oscillating theory of the universe, but it is not really a theory, for we know of no mechanism that can produce another big bang.").

A number of speculations have been made about ways the "missing mass" might exist, but are not supported by plausible data. Neutrinos, which have been suggested as a source of missing mass, appear to have no mass or at least not sufficient mass. ____, The Neutrino Lacks Weight, New Scientist, Nov. 5, 1981, at 371, ____ ("It looks as if neutrinos do not, after all, have mass. Recent claims to the contrary led to speculation that the existence of massive neutrinos might explain the nature of the missing mass, in the Universe and resolve the solar neutrino problem (New Scientist, vol. 86, p. 308). But the latest evidence from a study in Grenoble suggest that such optimism was unfounded. . . . If neutrinos have mass, then the theorists expect them to be involved in neutrino oscillations, with the electron neutrinos in the beam spontaneously converting to other neutrinos which would not produce this reaction. But . . . the Grenoble study revealed an energy spectrum of positrons produced consistent with no neutrino oscillations in the beam."); Kwon* et al., Search for Neutrino Oscillations at a Fission Reactor, 24 Physical Review D 1097,

be far less than the quantity of matter: "the prevailing opinion among astronomers and astrophysicists is that matter dominates over antimatter in the present universe."623/

1097 (1981); Waldrop*, Neutrinos: No Oscillations?, 216 Science 605, ___, (1982)("Opening another chapter in a continuing controversy, a team of American, German, and Swiss physicists have reported new evidence casting doubt on the idea that neutrinos exhibit a bizarre phenomenon called 'oscillation'.").

622. "Antimatter" is defined as follows by an American Institute of Physics publication:

> ANTIMATTER--It is believed that all particles have antimatter counterparts, particles with identical mass and spin as the original but with many other properties (such as electric charge) reversed. Although few such particles exist in nature, many have been produced artifically in laboratories and small amounts are created in space by cosmic ray collisions. The question of whether material, or even whole galaxies, could be made from antiparticles is being investigated. Presently there is no evidence for such antigalaxies.

Glossary of Terms Used in Cosmology 2 (P. Schewe* ed. 1982).

623. Wilczek*, The Cosmic Asymmetry between Matter and Antimatter, Scientific

Summary. This thermodynamics argument supports cosmic creation, and presents a

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American, Dec. 1980, at 82, 83. Accord, Weisskopf, The Origin of the Universe, 71 American Scientist 473, 479 (1983) ("We are pretty sure from our observations that the universe today contains matter but very little if any antimatter."). Three major problems with hypotheses of equal quantities of matter and antimatter are noted by Silk*:

> First, if the Alfvén-Klein cosmology is correct, some mechanism must separate regions of matter and antimatter. Since we know that even intergalactic space contains some matter, galaxies could not be completely separated from antigalaxies . Alfvén has proposed a possible way of separating regions of matter and antimatter, but other astrophysicists remain skeptical about his theory. Second, there must be many regions where annihilation of matter and antimatter would occur. One result of annihilation is to produce copious amounts of high energy gamma rays, which should be observable by space experiments. Astronomers have indeed measured a diffuse cosmic background of gamma rays, but the flux is relatively low. The implication is that very little annihilation can be occurring at present.
>
> Perhaps the most significant objection to this cosmology stems from the presence of the cosmic background radiation.

material factual issue about the scientific nature of creation-science and evolution.

(b) Radiohalos Argument for Cosmic Creation. The radiohalos argument is based on the presence of certain polonium halos in the earth's crust, which effectively require a nearly instantaneous appearance of the earth in complex form. A "radiohalo" or radioactive halo is a discolored region in a mineral that contains a radioactive ele-

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J. Silk*, The Big Bang 319-21 (1979). Accord, Lake*, Windows on a New Cosmology, 224 Science 675, 679 (1984) ("To arrange for the degree of homogeneity that must have been present in the early Universe and yet separate matter and antimatter on scales of galaxies or clusters of galaxies seems an impossible task after nearly two decades of effort (16). Why then is there a pronounced matter-antimatter asymmetry in the Universe?"); Wilczek*, The Cosmic Asymmetry between Matter and Antimatter, Scientific American, Dec. 1980, at 82, 83 ("What ultimately seems decisive is the difficulty of imagining how matter and antimatter in the early universe could have become segregated into distinct regions. It seems more likely they would have simply annihilated each other everywhere.").

ment, and the discolored region consists of spheres around the radioactive element produced usually by alpha particles emitted as the radioactive element decays. Polonium is a radioactive element, and it too decays (218_{Po} decays into 214_{Po}, then into 210_{Po}, then into to 206Pb (lead)). A "polonium halo" is a discolored region of tiny spheres formed around polonium as it decayed in generally mica or fluorite in granite. Three forms of polonium (218_{Po}, 214_{Po} and 210_{Po}) decay very rapidly, so that their halflives (a half life is the time required for half of a radioactive material to decay) of these three polonium isotopes are extremely short (3.05 minutes, 16/100,000 second, and 138.4 days respectively).624/

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624. Kazmann*, It's About Time: 4.5 Billion Years, Geotimes, Sept. 1978, at _____; Feather*, _____, 11 Royal Society of Edinburgh Commun. 147, 147 (1978); Gentry, Radiohalos in a Radio-

The significance of these polonium halos is described by Kazmann* of LSU:

> The polonium halos, especially those produced by Po218 are the center of a mystery. The halflife of the isotope is only 3 minutes. Yet the halos have been found in granite rocks in many parts of the world, including Scandinavia, India, Canada, and the United States. The difficulty arises from the observation that there is no identifiable precursor to the Polonium; it appears to be primordial polonium. If so, how did the surrounding rocks crystallize rapidly enough so that there were crystals available ready to be imprinted with radiohalos by a-particles from Po218? This would imply almost instantaneous cooling and crystalization of these granitic minerals --and we know of no mechanism that will remove heat so rapidly; the rocks are supposed to have cooled over millenia, if not tens of millenia.625/

The "world's foremost expert on the observation and measurement of radiohalos"626/

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chronological and Cosmological Perspective, 184 Science 62, (1974); note 627 infra.

625. Kazmann*, It's About Time: 4.5 Billion Years, Geotimes, Sept. 1978, at __, _____. Kazmann* does not agree with Gentry's interpretations.

626. National Science Foundation*, NSF Program Review Evaluation of NSF Propo-

is Gentry, a creationist scientist, who has researched polonium halos for 20 years and published many articles on his research in more than a dozen standard scientific publications.627/ He summarizes the way in

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sal "Investigations of Polonium Radiohalos", (Sept. 1979).

627. Gentry, Abnormally Long Alpha-Particle Tracks in Biotite (Mica), 8 Applied Physics Letters 65 (1966); Gentry, Antimatter Content of the Tunguska Meteor, 211 Nature 1071 (1966); Gentry, Alpha Radioactivity of Unknown Origin and the Discovery of a New Pleochroic Halo, 1 Earth and Planetary Science Letters 453 (1966); Gentry, Extinct Radioactivity and the Discovery of a New Pleochroic Halo, 213 Nature 487 (1967); Gentry, Fossil Alpha-Recoil Analysis of Certain Variant Radioactive Halos, 160 Science 1228 (1968); Gentry, Giant Radioactive Halos: Indicators of Unknown Alpha Radioactivity?, 169 Science 670 (1970); Gentry, Radioactive Halos in the Lunar Environment, 1 Proc. Second Lunar Science Conf. 167-168 (1971); Gentry, Radiohalos: Some Unique Pb Isotope Ratios and Unknown Alpha Radioactivity, 173 Science 727 (1971); Gentry, Ion Microprobe Confirmation of Pb Isotope Ratios and Search for Isomer Precursors in Polonium Radiohalos, 244 Nature 282 (1973); Gentry, Radioactive Halos, 23 Annual Review of Nuclear Science 347 (1973); Gentry, Radiohalos in a Radiochronological and Cosmological Perspective,

which polonium halos provide affirmative evidence for creation of the earth:

> My challenge to this view hinges on the simple fact that I claim the various types of polonium halos that exist in these Precambrian granites initiated

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184 Science 62 (1974); Gentry, "Spectacle" Array of 210Po Halo Radiocentres in Biotite, 252 Nature 564 (1974); Gentry, Spectacle Halo--Reply to Comments, ___ Nature ___ (1975); Gentry, et al., Radiohalos in Coalified Wood: New Evidence Relating to Time of Uranium Introduction and Coalification, 194 Science 315 (1976); Gentry et al., Evidence for Primordial Superheavy Elements 37 Physical Review Letters 11 (1976); Gentry, et al., Search with Synchrotron Radiation for Superheavy Elements in Giant-Halo Inclusions, 38 Physical Review Letters 205 (1977); Gentry et al., Evidence Against Superheavy Elements in Giant-Halo Inclusions Re-examined with Synchrotron Radiation , 40 Physical Review Letters 507 (Feb. 20, 1978); Gentry, Are Any Unusual Radio Halos Evidence for SHE?, Proc. International Symposium on Superheavy Elements, Lubbock, Texas, March 9-11, 1978, ____ (1978); Gentry, et. al., Reinvestigation of the [Alpha]-Activity of Conway Granite, 273 Nature 217 (May 18, 1978); Gentry, et al., Implications on Unknown Radioactivity of Giant and Dwarf Halos in Scandinavian Rocks , 274 Nature 457 (Aug. 3, 1978); Gentry, Time: Measured Responses 60 EOS 474 (1979); Gentry, Polonium Halos 61 EOS 514 (1980); Gentry, et al., _____.

> from primordial rather than secondary Po radioactivity, and that these primordial Po halos constitute prima facie evidence of a virtually instantaneous creation of these rocks.628/

> Likewise, unless the creation of the radioactivity and rocks were simultaneous there would be no picture--no [polonium] halos. Further, by virtue of the very short half-life, the radioactivity and the formation of the rocks must be almost instantaneous.629/

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628. Gentry, Letter, Physics Today, Apr. 1983, at 13, 13.

629. Gentry, Cosmology and the Earth's Invisible Realm, Medical Opinion and Review, Oct. 1967, at 65, 78. Accord, R. V. Gentry, Spectacle Haloes: Reply, 258 Nature 269, 270 (1975)("Carried to its ultimate conclusion, this means that polonium haloes, of which there are estimated to be more than 10-15 in the earth's basement granite rocks, represent evidence of extinct natural radioactivity, and thus imply only a brief period between 'nucleosynthesis' and crystallization of the host rocks."); R.V. Gentry, Radiohalos in a Radiochronological and Cosmological Perspective, 184 Science 62, _____ (1974) ("A further necessary consequence, that such Po halos could have formed only if the host rocks underwent a rapid crystallization, renders exceedingly difficult, in my estimation, the prospect of explaining these halos by physical laws as presently understood."); R. V. Gentry, Cosmology and Earth's Invisible Realm, Medical Opinion and Rev., Oct. 1967, at 65,

To spell this out further, the polonium halos come from polonium that was present in the earth's crust when the earth originated, first because they are in primordial granite that has not been formed since,630/ and second because no uranium or thorium halos are present (polonium ordinarily comes from uranium and/or thorium decay).631/ The

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78 ("This would imply that in some instances only a few seconds elapsed before the radioactivity responsible for certain anomalous halos became extinct. Yet if this extinct radioactivity existed for only a few seconds, how did it get buried in the crystal rocks? This is impossible according to some theories of the origin of the earth.").

630. Gentry, Spectacle Haloes: Reply, 258 Nature 269, 270 (1975) ("Earth's basement granitic rocks"); Gentry, Time: Measured Responses, 60 E.O.S. [Trans. Am. Geophysical U.] 474, 475 (1979) ("basement rocks"); Gentry, Cosmology and Earth's Invisible Realm, Medical Opinion and Rev., Oct. 1967, at 65, 78.

631. R.V. Gentry, et al., 'Spectacle' Array of 210 Polonium Halo Radiocentres in Biotite: A Nuclear Geophysical Enigma, 252 Nature 564, 566 (1974)("Because the Pb isotope in these inclusions is not explicable as any combination of common , primordial, or from in situ Pb derived radiogenically

polonium halos could only form in cool rock and not in molten rock.632/ Because polonium decays so rapidly, two halos (^{218}Po and ^{214}Po) had to form in a few minutes and the third halo (^{210}Po) in a few years. Thus the earth's crust either had to come into existence in cool form or had to cool in a few minutes. Further, Dr. Gentry has outlined specific ways in which his conclusions are falsifiable (and they have not been falsified).633/

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in situ from U or Th, we conclude that a different type of Pb, derived from Po [alpha] decay, exists in nature."); Gentry, Spectacle Haloes: Reply, 258 Nature 269, 270 (1975) ("Uranium-daughter diffusion did not produce polonium haloes in rocks"). The absence of any uranium and/or thorium can be determined by scanning electron microscope x-ray fluorescence and ion microprobe mass spectrometry, and is in stark contrast to the evidence of uranium and/or thorium in uranium and thorium halos.

632. See Gentry, Radiohalos in a Radiochronological and Cosmological Perspective, 184 Science 62, ____(1974).

633. Gentry has published several times this possible method of falsifica-

Summary. This radiohalos argument sup-

tion:

> For over 3 1/2 years I have challeneged geologists and others who believe in the evolutionary development of the granites to confirm that hypothesis, first, by synthesizing a hand-sized piece of granite, and second, by synthesizing a single Po218 halo in that same piece of granite. The first requirement would be accepted as falsifying my view that the granites are primordial or created rocks, and the second would falsify my view that the Po halos in granites represent primordial radioactivity. With such a grand opportunity to confirm evolution and falsify my view of creation, I have searched for a reason for the deafening silence which my challenge has met.

Gentry, Letter, Physics Today, Apr. 1983, at 13, 13. Accord, Gentry, Time: Measured Responses, 60 E.O.S. [Trans. Am. Geophysical U.] 474, 475 (1979) ("I will likewise relinquish any claim for primordial 218_{Po} halos when coercive evidence (not just plausibility arguments) is provided for a conventional origin. . . . I will consider my thesis to be doubly falsified by the synthesis of a biotite which contains just one 218_{Po} halo (some of my natural speciments contain more than 104_{Po} halos/cm3). R. V. Gentry, _____, 60 EOS 4747 (1979); Gentry, _____, 61 EOS 514 (1980); Gentry, _____, 184 Science 62 (1974); Gentry, _____, 23 Ann. Rev. Nuc. Sci. 347 (1973); R. V. Gentry et al., _____, 194 Science 315 (1976).

ports cosmic creation, and presents a material factual issue about the scientific nature of creation-science and evolution.

(c) Information Content Argument for Cosmic Creation. This argument is based on the vast information content of the universe, with predictable and orderly motion of galactic clusters, their galaxies, their stars, our solar system, and comets. This "greatest puzzle" of the vast information content in the universe is acknowledged by Davies*:

> Everywhere we look in the Universe, from the far flung galaxies to the deepest recesses of the atom, we encounter order. . . .
>
> . . . .
>
> Central to the idea of a very special, orderly Universe is the concept of information. A highly structured system, displaying a great deal of organised activity, needs a lot of information to describe it. Alternatively, we may say that it contains much information.636/

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636. Davies*, Chance or choice: is the Universe an accident?, _____ New Scientist

The "present immense complexity of the universe" is also recognized by Gamow*, a formulator of the big bang hypothesis, as well as Arp* and Weisskopf*, with interesting implications under the second law of thermodynamics (law of entropy).637/

506, 506 (1978). He writes elsewhere:

> There is good evidence that the primeval universe was not ordered but highly chaotic: a relic of the primordial chaos survives in a curious radiation from space, believed to be the last fading remnant of the primeval heat, and the characteristics of its spectrum reveal that in the earliest moments of the universe the cosmological material was completely unstructured.
>
> . . ..
>
> The greatest puzzle is where all the order in the universe came from. It could not come by random shuffling.

Davies*, Universe in Reverse--Can Time Run Backwards?, _____ Second Look 26 (1982).

637. G. Gamow*, The Creation of the Universe 20 (1955)("We may also assume that in that distant past our universe was considerably less differentiated and complex than it is now and that the state of matter at that time could be accurately described by the classical concept of primordial chaos . . . the problem of scientific cosmogony can be formulated as an attempt to recon-

The core of this information content argument--the complex order in the universe--was actually formulated by Sir Isaac Newton, the great physicist, who for example said of the solar system:

> The six primary planets are revolved about the sun in circles concentric with the sun, and with motions directed towards the same parts , and almost in the same plane. Ten moons are revolved about the earth, Jupiter, and Saturn, in circles concentric with them, with the same direction of motion, and nearly in the planes of the orbits of those planets; but it is not to be conceived that mere mechanical

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struct the evolutionary process which led from simplicity of the early days of creation to the present immense complexity of the universe around us."). Accord, H. Arp*, Atlas of Peculiar Galaxies (1966); Weisskopf*, The Frontiers and Limits of Science, 65 American Scientist 405-11 (1977) ("This evolutionary history of the world, from the 'big bang' to the present universe, is a series of gradual steps from the simple to the complicated, from the unordered to the organized, from the formless gas of elementary particles to the morphic atoms and molecules, and further to the still more structured liquids and solids, and finally to the sophisticated living organisms.").

> causes could give birth to so many regular motions, since the comets range over all parts of the heavens in very eccentric orbits.638/

This vast information content (or complex order) is best explained by cosmic creation, as Newton concluded, rather than by evolutionary causes.639/

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638. I. Newton, Principia Mathematica (2d ed. 1686, F. Cajori trans. 1960). Bush* recently acknowledged the same complex order:

> We do not yet have an explanation for all the observed regularities of the solar system. It is by studying such patterns that we hope to arrive at a theory that will explain its origin. Even in the absence of a completely satisfactory theory, however, one thing seems certain: the order of the solar system represents an efficient means of self-regulation. The nearly circular orbits of the planets allow for the safest flow of traffic. Bodies which disobeyed these traffic regulations and did not conform to the regular orbital pattern would sooner or later aporoach too close to other bodies. As a result of such encounters, they would either be torn apart by tidal forces, or accelerated out of the solar system entirely.

F. Bush*, Astronomy 420 (1977).

639. Id. All parts of his specific deduction are not scientific.

Summary. This information content argument supports cosmic creation, and presents a material factual issue about the scientific nature of creation-science and evolution.

(d) Heterogeneity Argument for Cosmic Creation. The heterogeneity argument is founded on the significantlv uneven distribution of matter in the universe (the lumpiness of the universe). This heterogeneity is described by Peebles* and others* as follows:

> The large-scale distribution of matter is strikingly clumpy; we see stars in galaxies, galaxies in groups and clusters, and clusters in superclusters (1).640/

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640. Peebles*, The Origin of Galaxies and Clusters of Galaxies, 224 Science 1385, 1385 (1984). Gregory* and Thompson* concur:

> It has become abundantly clear from the red-shift surveys that the present-day distribution of galaxies is highly inhomogeneous out to a distance of several hundred million light-years. It seems probable that the inhomogeneity extends out to bil-

This "is in fact one of the major unsolved problems of cosmology," and the heterogeneity problem was underscored by the recent discovery of a "300-million-light-year gap in the distribution of galaxies"641/ as well as by the contrasting homogeneity of the cosmic background radiation.642/ The

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lions of light-years and characterizes the entire universe.
Gregory* & Thompson*, Superclusters and Voids in The Distribution of Galaxies, Scientific American, March 1982, at 106, 113. Accord, Waldrop*, Delving the Hole in Space, 214 Science 1016, 1016 (1981) ("a striking tangle of clumps and filaments and voids"); Guth* & Steinhardt*, The Inflationary Universe, Scientific American, May 1984, at 116, 119 ("the clumping of matter into galaxies, clusters of galaxies, superclusters of clusters and so on"). Peebles* notes that homogeneity exists on the average over scales beyond 30 megaparsecs.

641. Waldrop*, Delving the Hole in Space 214 Science 1016, 1016 (1981). Accord, Kirshner*, et al., _____, 248 Astrophysics J. Letters L57 (1981); Silk*, Great Voids in the Universe 295 Nature 367-368 (1982).

642. Silk*, Great Voids in the Universe, 295 Nature 367, 367 (1982). Accord, Leslie*, Cosmology, Probability, and the Need To Explain Life, in Scientific Explanation and Understanding 53, 54 (N. Rescher ed. 1983).

current heterogeneity of the universe conflicts with the standard big bang explanation,643/ and requires "a peculiar state of extraordinary but not quite perfect uniformity" during the postulated first fraction of a second after the big bank that cosmologists describe as the "smoothness problem."644/

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643. Seiden* states:

> The standard Big Bang model does not give rise to lumpiness. That model assumes the universe started out as a globally smooth, homogeneous expanding gas. If you apply the laws of physics to this model, you get a universe that is uniform, a cosmic vastness of evenly distributed atoms with no organization of any kind.

B. Patrusky*, Why Is the Cosmos Lumpy?, Science 81, June 1981, at 96, 96. Accord, Guth* & Steinhardt*, The Inflationary Universe, Scientific American, May 1984, at 116, 119.

644. Guth* & Steinhardt*, The Inflationary Universe, Scientific American, May 1984, at 116, 119. They state in full:

> Even with the assumption of large-scale uniformity, the standard big-bang model requires yet another assumption to explain the nonuniformity observed on smaller scales. To account for the clumping of matter into galaxies, superclusters of clusters and so on, a spectrum of primordial inhomogeneities

On the other hand, this heterogeneity is more plausibly explained by cosmic creation than by cosmic evolution.

Summary. This heterogeneity argument supports cosmic creation, and presents a nature of creation-science and evolution.

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must be assumed as part of the initial conditions. The fact that the spectrum of inhomogeneities has no explanation is a drawback in itself, but the problem becomes even more pronounced when the model is extended back to 10^{-45} second after the big bang. The incipient clumps of matter develop rapidly with time as a result of their gravitational self-attraction, and so a model that begins at a very early time must begin with small inhomogeneities. To begin at 10^{-45} second the matter must start in a peculiar state of extraordinary but not quite perfect uniformity. A normal gas in thermal equilibrium would be far too inhomogeneous, owing to the random motion of particles. This peculiarity of the initial state of matter required by the standard model is called the smoothness problem.

Id. Accord, Lake*, Window on a New Cosmology, 224 Science 675, 678, 680 (1984) ("flatness problem"; "The horizon and flatness problems are certainly not solved.").

(e) Galaxy and Star Formation Argument for Cosmic Creation. The galaxy and star formation argument arises from the condensation of clusters of galaxies, of galaxies of stars, and of stars themselves.

Galaxy Formation. (i) First, the origin of galaxies poses a major problem, as Encyclopaedia Britannica notes:

> Origin of galaxies. One of the chief problems in cosmology is to explain why in an expanding universe matter becomes aggregated into galaxies.
>
> . . . .
>
> An expanding universe in fact is not dramatically unstable; and this has led to an impasse in the study of galaxy formation.645/

The problem is that galaxies could only form after a big bang explosion if highly improbable conditions existed (if at all): the expansion rate after the explosion had to be exact "by one part in a million mil-

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645. Harrison*, Universe, Origin and Evolution of, in 18 Encyclopaedia Britannica 1007, 1008 (14th ed. 1974).

lion" and the homogeneity (smoothness) had to be "extraordinary but not quite perfect":

> It seems, for instance, that altering the rate of expansion at the Big Bang very marginally would have made our universe fall to bits too fast or undergo recollapse too quickly for Life to stand a chance of evolving. Persuading expanding gases to form themselves into galaxies of stars and planets requires an adjustment of gravitational and explosive forces quite as delicate as that between the two halves of a pencil in balance on a razor's edge. . . .
>
> (a) True, galaxy formation is not well understood. Yet the now standard (Friedmann-Robertson-Walker) models of our universe are extremely sensitive to small changes in the expansion rate (and hence to the strength of the gravitational force). Reduction by one part in a million million at an initial stage would seemingly have led to recollapse in under 100,000 years and before temperatures had fallen below 10,000 degrees. Equivalently tiny increases would have had similarly huge results. Even as matters stand it is hard to see how galaxies could have formed in a universe which is flying apart so fast--and an early speed increase by one thousandth would quickly have led to a thousandfold increase. (b) Again, very slight reductions in the smoothness with which matter is distributed . . . would apparently have multiplied the primeval heat billions of times with disastrous effects.646/

This is described as "the miracle of the formation of the galaxies after the big bang" by Hoyle.646a/

(ii) Star Formation. Second, the origin of stars poses a similar problem, because for gas clouds "ordinarily the internal pressure is much stronger than the gravitation,"647/ so that the gas cloud would ex-

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646. Leslie*, Cosmology, Probability, and the Need To Explain Life, in Scientific Explanation and Understanding 53, 54 (N. Rescher ed. 1983). Breuer* concurs:

> The dilemma is a simple one: within the early phase, which was dominated by radiation, 'bunching' of matter was prevented. . . . After the decoupling of radiation and matter, it was not possible for the very small irregularities then present in the distribution of the gas to increase quickly enough to form entire galaxies.

Breuer*, Contact with the Stars 8 (19__). Guth* & Steinhardt* similiarly note this "smoothness problem." Note 644 supra.

646a. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution _____ (1983). Accord, J. Silk*, The Big Bang 315 (1979) ("The Big Bang theory has not yet resolved . . . the nature of the galaxies.").

pand rather than contract to form a star. Before any stars existed, a fluctuation in the gas pressure could not be caused by star formation or supernovas (star explosion); and thereafter, fluctuations generally could not be great enough to overcome the great disparity between high outward gas pressure and low inward gravitational pressure. Similarly, the cool temperature that could cause a gas cloud to collapse would not come about after a hot big bang.648/ Moreover, no clear evidence exists that

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647. Cameron*, The Origin and Evolution of the Solar System, 233 Scientific American 35 (1975) (explaining star formation by fluctuations such as from "a supernova explosion, the formation of a massive star or a large rearrangement of the interstellar magnetic field"--"conditions which are quite rare").

648. Even if Bok Globules are an exception in possibly contracting, they are not sufficiently numerous to counterbalance the large number of dying stars, much less to have generated a significant portion of the vast present number of stars.

stars are currently forming, and although before the advent of the radio telescope they were alleged to form in dense dust clouds, radio telescopes have ruled out star formation inside observed dust clouds.

(iii) Solar System Formation. Third, the origin of the solar system presents similar problems, as Jeffreys* acknowledges:

> To sum it up, I think that all suggested accounts of the origin of the Solar System are subject to serious objections. The conclusion in the present state of the subject would be that the system cannot exist.649/

Summary. Overall, activity such as the formation of galaxies, galactic clusters,

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649. H. Jeffreys*, The Earth: Its Origin, History and Physical Constitution 359 (5th ed. 1970). Moreover, the "variations in the isotopic composition of meteorites" as well as of the sun and planets, and calculations of angular momentum, rule out the solar nebula hypothesis. Kerr*, Isotopic Anomalies in Meteorites: Complications Multiply, 202 Science 203, 203 (1978); A. Cameron*, The Origin and Evolution of the Solar System, Scientific American, Sept. 1975, at 33, 37.

stars, and solar systems simply does not result from an explosion such as the big bang.650/ This galaxy and star formation

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650. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 183-85 (1983)("This persistent weakness has haunted the big bang theory ever since the 1930s. It can probably be understood most easily by thinking to begin with of what happens when a bomb explodes. After detonation, fragments are thrown into the air, moving with essentially uniform motion. As is well-known in physics, uniform motion is inert, capable in itself of doing nothing. It is only when the fragments of a bomb strike a target--a building for example--that anything happens. . . . But in a single big bang there are no targets at all, because the whole universe takes part in the explosion. There is nothing for the expanding material to hit against, and after sufficient expansion, the whole affair should go dead. However, we actually have a Universe of continuing activity instead of one that is uniform and inert. Instead of matter all the time becoming colder and more spread out, we often see it clustering together to produce the brilliant light of swirling galaxies and exploding stars. Why should this be so against expectations which appear soundly based in all other aspects of physical experience?"); Hoyle, The Big Bang in Astronomy, 91 New Scientist 521, 523 (1981)("even though outward speeds are maintained in a free explosion, internal motions are not. Internal motions die away adiabat-

argument supports cosmic creation as the most plausible explanation, and presents a material factual issue about the scientific nature of creation-science and evolution.

Conclusion. Cosmic creation, like biological creation and biochemical creation, is scientific. It consists of at least five affirmative evidences, and not of mere weaknesses of cosmic evolution, in the areas of thermodynamics, radiohalos, information content, heterogeneity, and galaxy and star formation. These are material factual issues.

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ically, and the expanding system becomes inert, which is exactly why the big bang cosmologies lead to a universe that is dead and done with almost from its beginning.").